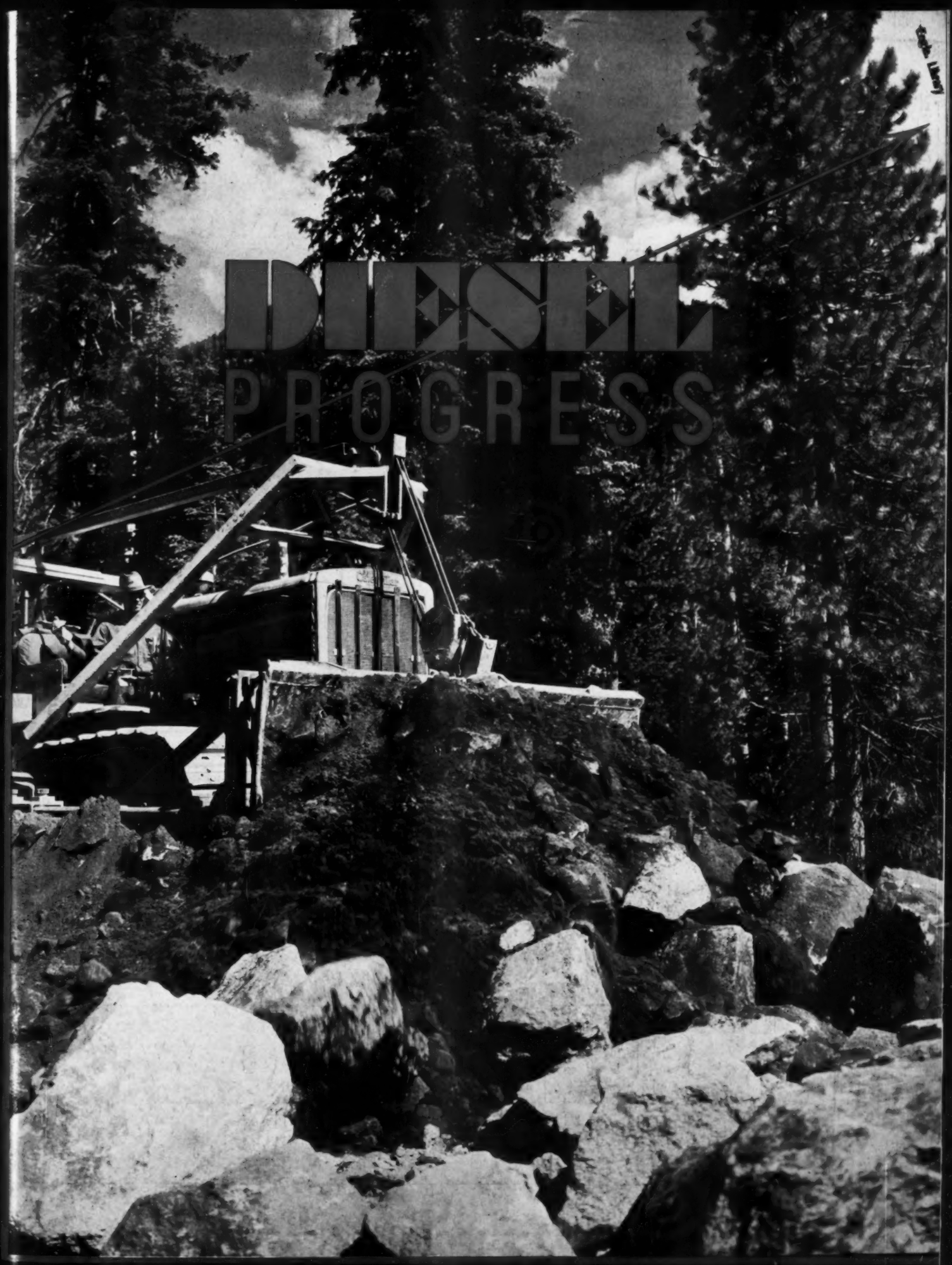


FEBRUARY, 1940 CIRCULATION OF THIS ISSUE—IN EXCESS OF 14,000 COPIES 25c

DIESEL PROGRESS for February, 1940. Volume VI, Number 2. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn New York, authorized May 14, 1935. Subscription rates: United States and Possessions $3.00 Canada and all other countries $5.00 per year. Single copy price 25 cents in U. S. A., 50 cents for all other countries.

DIESEL PROGRESS and DIESEL AVIATION

CONTENTS FEBRUARY 1940

CCA

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: As this issue comes off the press, the American Road Builders' Association opens its big Show in Chicago. The illustration on the front cover of a Caterpillar Diesel tractor with a LeTourneau angledozer at work typifies the ever-increasing place which Diesel engines have in National road building.

TABLE OF CONTENTS ILLUSTRATION: The greatest concentration of Diesel locomotives in railroad history occurred at Washington, D. C., at the formal opening of the Seaboard Railway's winter service to Florida. These sleek Electro-Motive monsters of the rails, powered with General Motors Diesel engines, are a part of a fleet that power thirteen deluxe and coach trains to the Southland this season.

DIESEL PROGRESS for February, 1940, Vol. VI, No. 2. Published monthly by Diesel Engines, Inc., 2 West 45th St., New York, N. Y. Tel. MUrray Hill 2-5092. Subscription rates: U.S.A. and Possessions $3.00 per year; 25c per copy. All other countries, $5.00 per year; 50c per copy.

HEYWORTH CAMPBELL
Art Director

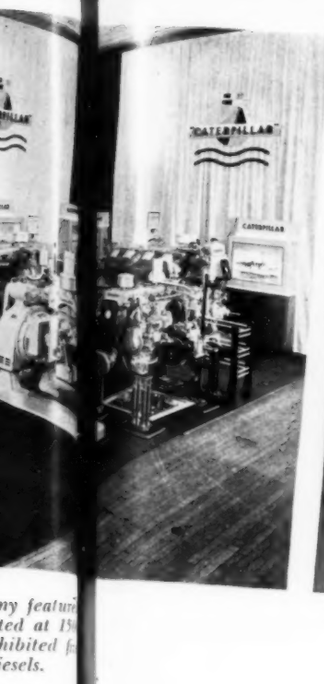
PAUL H. WILKINSON
Aviation Editor

The National Supply Company exhibited a new 8½" x 10½" 6-cylinder Superior Diesel rated 235 hp. at 700 rpm. and a 4-cylinder, 5½" x 7" Superior Diesel rated 90 hp. at 1200 rpm., in addition to their regular line of high speed Superiors.

Caterpillar Tractor Company featur their new 35 hp. Diesel rated at 1 rpm. In addition, they exhibited f of their standard marine Diesels.

The Buda-Lanova exhibit consisted of six Diesel engines ranging from 60 hp. to 248 hp., all using the Lanova type of combustion chamber.

Fairbanks, Morse & Company exhibited five Diesel engines, all of them new, ranging from the one-cylinder, 10 hp. Model 45, to the 8-cylinder, 320 hp. Model 35.



The Gray exhibit emphasized the full line of Diesels ranging from the one-cylinder, 25 hp. at 1600 rpm., to a six-cylinder 165 hp. at 2000 rpm.

The Kermath Mfg. Company exhibited two Diesel engines, both six-cylinder units; one rated at 84 hp. and the other at 113 hp., both being Hercules Diesel conversions.

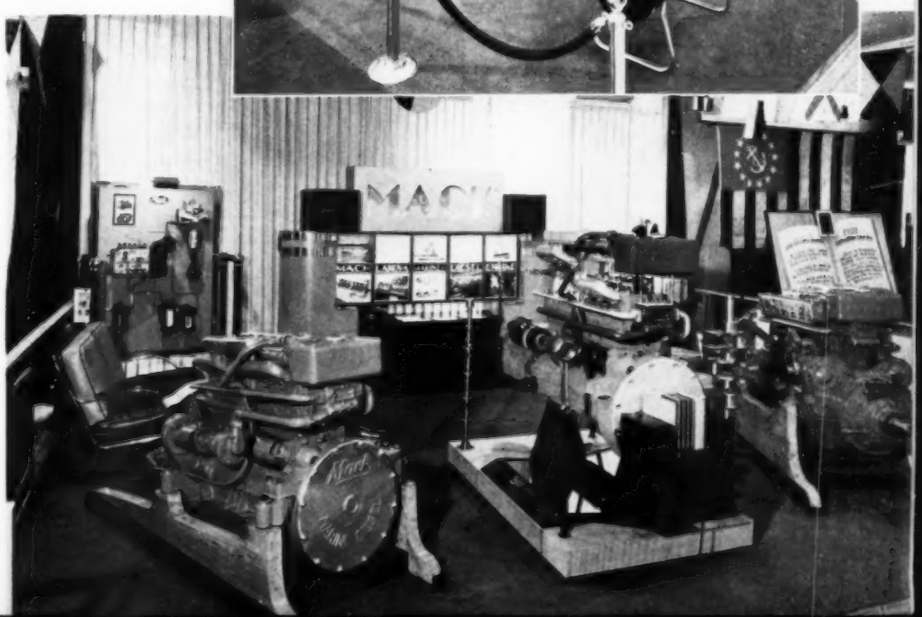
THE MOTOR BOAT SHOW

Diesels Dominated the 1940 New York Motor Boat Show, Even More So Than They Did Last Year—Seventeen Different Makes of Diesels Were Exhibited, an All Time "High."

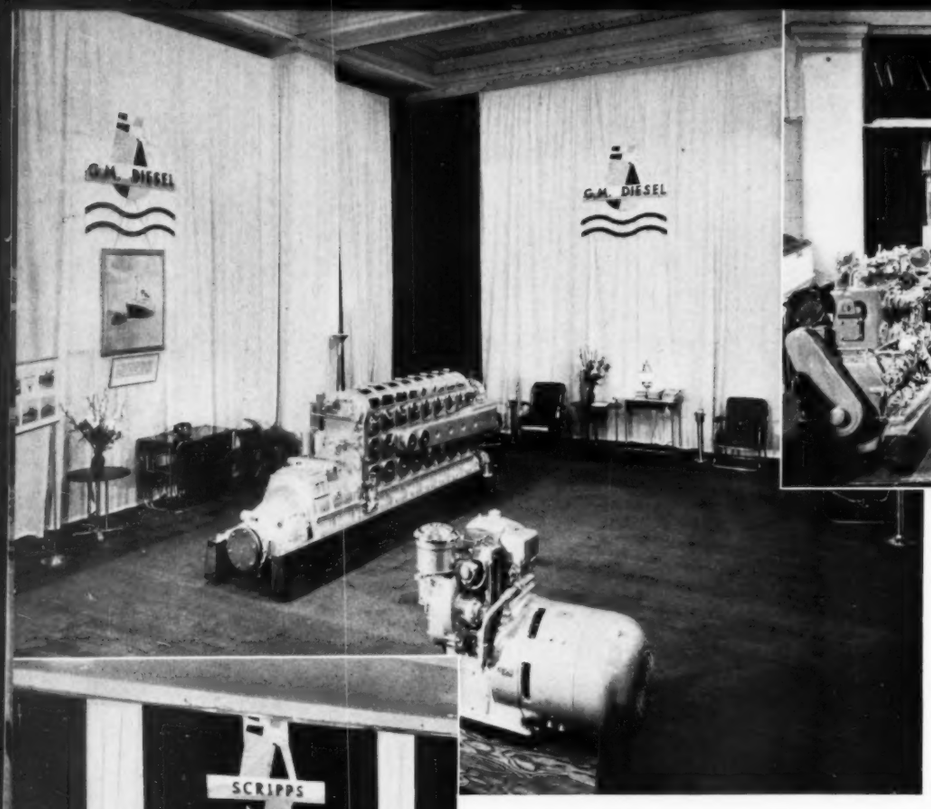
THIS decidedly successful Show ran from January 5th to 13th at the Grand Central Palace in New York. Attendance was excellent; interest in exhibits was very satisfactory. This was particularly true of the Diesel exhibits. A great majority of the people found these displays the high spot of the show, plied the exhibitors with intelligent questions, and discussed in detail the application and operation of marine Diesels from the standpoint of really interested potential buyers.

Due to the wide range of marine Diesel types and horsepower ratings represented, guests of the Show were able to find the exact units to meet their requirements; whether for work or for pleasure; main propulsion or auxiliary service; two-cycle or four-cycle operation; or direct, gear or V-belt drive. While accurate figures on sales during the Show are not available at this time, there can be no doubt that the keen interest shown will be translated into

The little Atlas-Lanova dominated the Atlas Imperial Diesel engine booth: 1 cylinder, 3 kw., 3 cylinder 9 kw. battery charging sets and a 3 cylinder marine Diesel; all 3 1/8" x 3 3/4", rated 5 hp. per cylinder at 1800 rpm. Also shown was a standard 6 cylinder Atlas Imperial block type 6 1/4" x 8 1/4" rated 135 hp. at 900 rpm. →

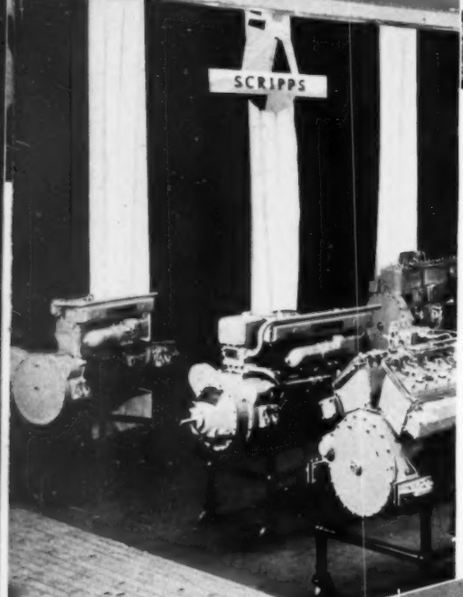


Another outstanding Lanova type engine at the Show was the Mack-Lanova, adapted for marine service: The Type Y for yachts and the Type W for work boats, both 4 cylinder units.

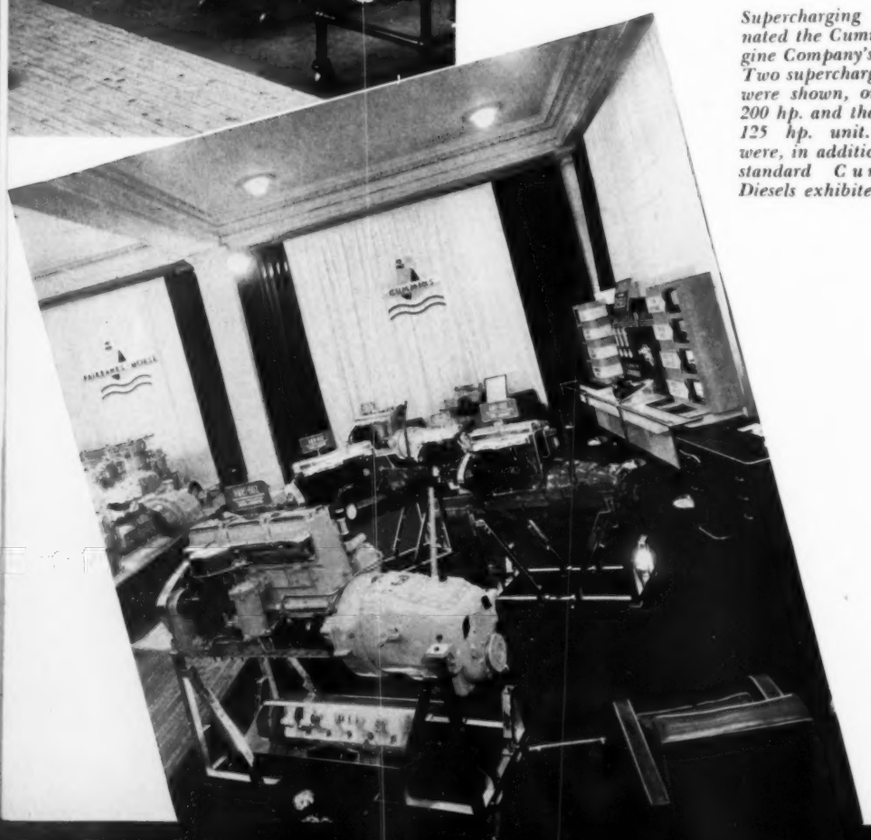


The Waukesha Motor Company again exhibited the Waukesha-Hesselman "Wanderer" and "Defender," rated at 215 hp. and 80 hp., respectively.

General Motors Diesel exhibit was, as usual, exciting and interesting, consisting of an 8-cylinder in-line special marine model of their 2-cycle Diesel engine and the 1-cylinder 10 kw. auxiliary Diesel-electric generating set.



The Scripps Motor Company for the first time exhibited two Diesel engines: both 6-cylinder models, one rated at 84 hp. and the other at 70 hp., both at 2600 rpm. These are Hercules Diesel conversions.



Supercharging dominated the Cummins Engine Company's exhibit. Two supercharged units were shown, one rated 200 hp. and the other a 125 hp. unit. There were, in addition, three standard Cummins Diesels exhibited.

orders and deliveries in the near future. For the benefit of those unable to attend this year's Show, illustrations and brief comments on the principal exhibits appear on this and the two preceding pages.

In addition to the exhibits illustrated on these three pages, Palmer Bros. Engines, Inc., Cos Cob, Connecticut, featured a four-cylinder 4⅛" bore, 6" stroke marine Diesel engine rated at 40 hp. at 1200 rpm. This new unit is equipped with a Palmer patented combustion system which is quite ingenious. The Lathrop Engine Company of Mystic, Connecticut, showed two straight marine Diesels, a 4-cycle, 5½" x 7" 50 hp. at 800 rpm., and a 6-cylinder, 4-cycle 80 hp. at 800 rpm. The U.S. Motors Corp. of Oshkosh, Wisconsin, featured two Hercules Diesel adaptations, one a 4-cylinder, 10 kw. Diesel-electric battery charging set, and the other a two-cylinder 5 kw. battery charging set. The Red Wing Motor Co. of Red Wing, Minnesota, exhibited a marine conversion of the Waukesha-Hesselman 6-cylinder, 65 hp. 3¾" x 4¼" spark ignition oil engine which they designate as the Red Wing-Hesselman engine. As usual, the Sterling Engine Company of Buffalo, New York, exhibited the Sterling horizontal "uniflow" Diesel which eliminates crankshafts, camshafts, and valves due to its unique construction.

All in all, the thirty-fifth Annual Motor Boat Show emphasized to a high degree the public acceptance of the Diesel engine for use in yachts, motor boats, and work boats of all types. From all indications gained at the Show, 1940 will be a splendid year for marine Diesel engine manufacturers.

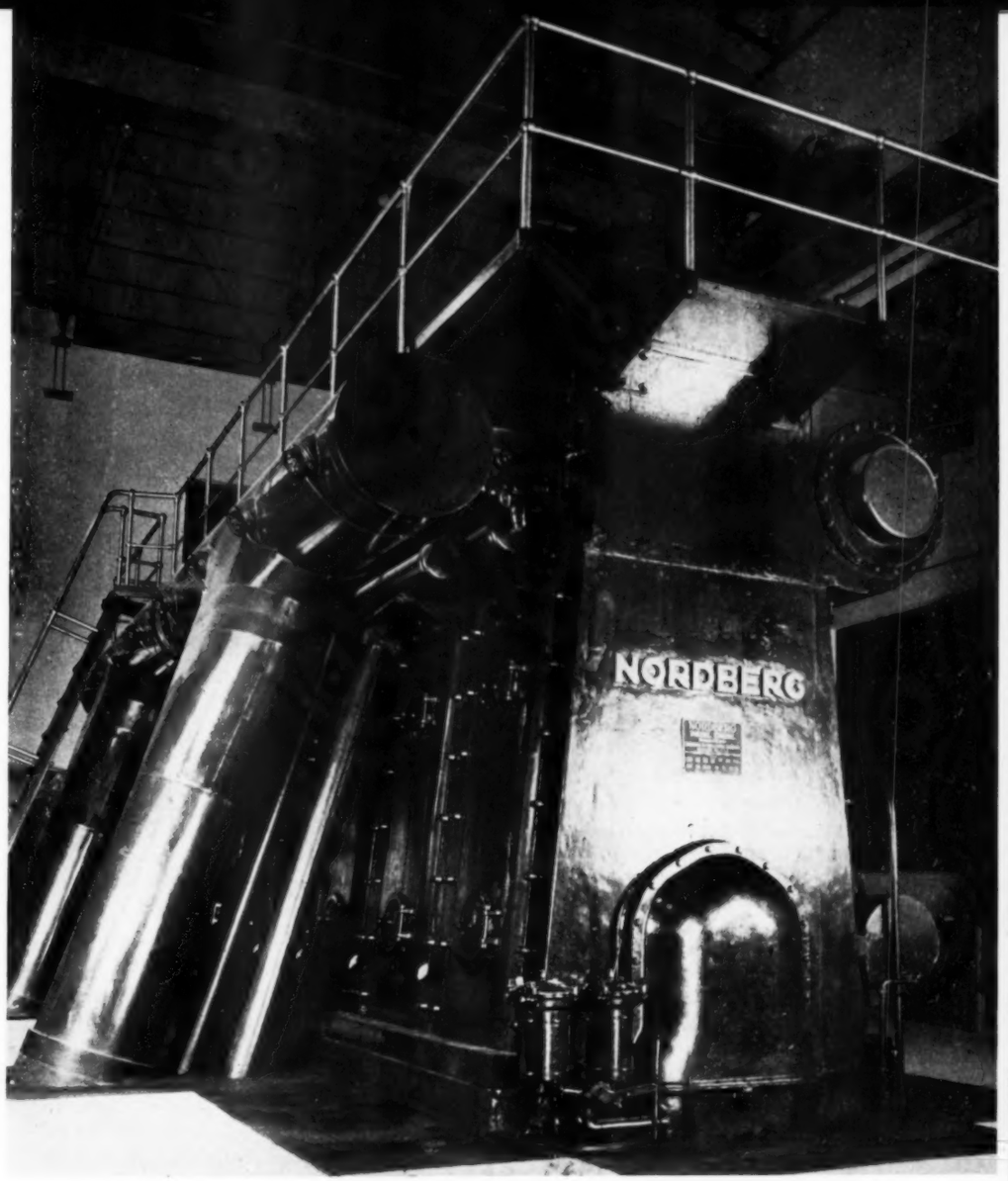
THE ELECTRIC LIGHT COMPANY BERMUDA

By REX W. WADMAN

PEMBROKE, Bermuda, January 1, 1940—Like Topsy who "just grew," so did the Bermuda Electric Light, Power & Traction Co., Ltd. From a lowly start, away back in 1906, with a 50 kw. Otto gas producer set operating a Nash gas engine and a belt-driven Crocker-Wheeler alternator, to a modern 8,250 kw. capacity Diesel plant producing an average of a million kwhrs. a month, I'll say that Topsy grew.

My reason for raising the question at all or for being down on this delightful island is that the latest addition to this extremely interesting plant is an 8-cylinder, 3,180 hp. Nordberg Diesel—the first time an American Diesel engine manufacturer has been able to get a foothold on this "tight little island," which, by the way, is just as calm, quiet, and restful as it has ever been. Those of us from the States, who have come down here for the holiday season, have lived the life of Riley. No evidence of war, no needless restrictions—just Bermuda, ageless, soul satisfying, catering wholeheartedly and with old world hospitality to the "guests within its gates."

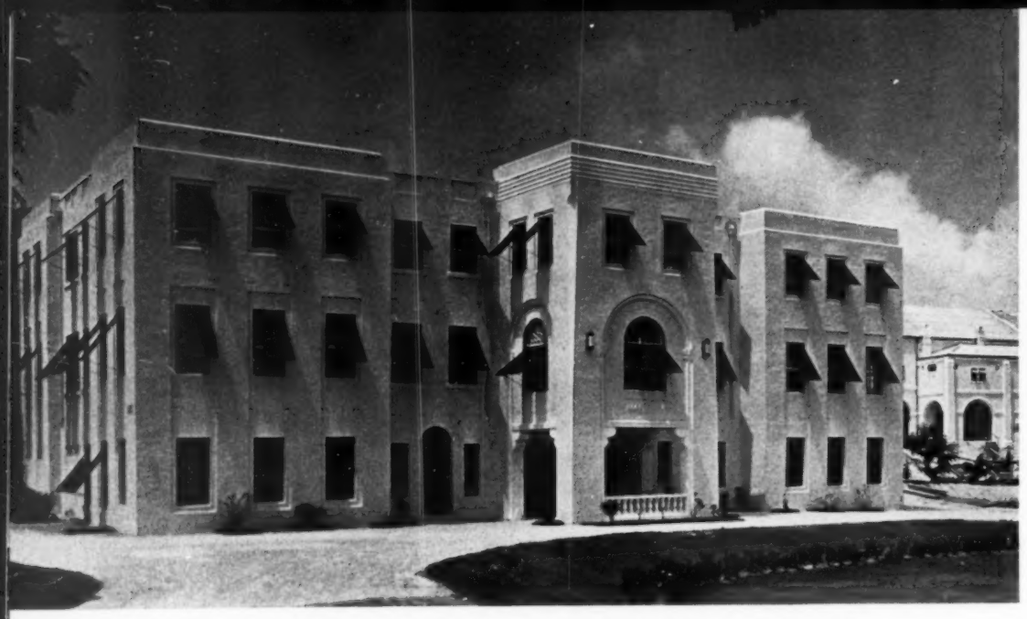
To get back "to my muttons," this Diesel plant here is interesting in many, many ways and I'm going to try and tell you about it. This successful and profitably operated public utility started under severe handicaps back there in 1906. In those good old days, the City Fathers objected violently to such new fangled ideas as electric lights and electric power, in fact served injunctions and other typical methods of stopping the original organizers from getting started. But a hardy pioneering spirit and intestinal fortitude characterized the fathers of the Electric Light Company, as it was then known, and started, they did—with a 50 kw. gas producer set. From time to time they added additional gas producer sets as the load increased, until 1921, when they installed their first oil engine, a 300 kw. Vickers Petters Semi-Diesel set. In 1923 came along a 300 kw. Campbell solid injection Diesel then, in January of 1925, a 750 kw. 6-cylinder, 14″ x 16″, 240 rpm., English Electric Fullagar opposed piston, 2-cycle full Diesel went on the line and that really started the plant going as full Diesel plant, because, in 1926, all the old gas producers were retired.



The eight cylinder, 3,180 hp., two cycle Nordberg Diesel installed in the plant of the Bermuda Electric Light, Power & Traction Co., Ltd., Pembroke, Bermuda. Note Nugent fuel oil filter in foreground.

Plant capacity rapidly extended and in December, 1926, an additional Fullagar of 750 kw. was added. Then in January, 1930, they installed a really big unit—a 1,000 kw., 8-cylinder, 14″ x 16″ at 240 rpm. Fullagar. This was followed on December, 1931, with a 1,500 kw., 6-cylinder, 19″ x 22″ at 200 rpm. Fullagar. All of these four opposed piston English Electric Fullagars were of the air injection type, although the first unit, bought in 1925, was changed over, right here in the plant, under Mr. Basil Seymour's direction in 1939, to mechanical injection. The load went on growing so in July, 1937, another Fullagar went on the line, this time a 2,000 kw., 8-cylinder, 19″ x 22″ mechanical injection machine operating at 200 rpm.

Even that big unit wasn't capable of stemming the constant rise in power demand here on the Island. So this time the Board of Directors turned to the United States. As a net result a 3,180 hp., 8-cylinder, 21″ x 31″, 2-cycle, crosshead, mechanical injection Nordberg Diesel went on the line here November 1, 1939, and it is that portion of the installation here with which I will now deal.



Executive offices of the Bermuda Electric Light, Power & Traction Co., Ltd., Pembroke, Bermuda. The power plant is in background.

In general, the 8-cylinder Nordberg in this plant was built to the same specifications as the twenty engines the Nordberg Manufacturing Company has built and is building for the Maritime Commission, except that the Maritime engines are of 29″ stroke, but all of the same bore; namely, 21″. In fact, this engine is similar to the 6 cylinder unit at Hillsdale, Mich., described in the January, 1940, issue of DIESEL PROGRESS and the 8 cylinder, dual fuel burning engine now operating on gas in the U. S. Indian Irrigation Plant at Coolidge, Ariz., which will be described in the March issue. This is just a simple, 2-cycle, crosshead engine employing the port scavenging system (an engine driven Roots blower is used).

Mounted on the bedplate and bolted to it are the columns which support the cylinders. Bedplate, columns and cylinders are tied together vertically with long tie-rods, or through-bolts, anchored in the bedplate at the sides and below each of the main bearings and extending to the top of the cylinders. These through-bolts take all the tensile stresses set up in the operation of the engine, the frame members being always under compression. Each through-bolt is given the same stress and the entire assembly, when tightened down, maintains equal tension in all bolts under all conditions of service.

Built into the engine is a complete pressure system of lubrication which not only lubricates but also supplies the oil for cooling the pistons. A complete piping system was supplied here with the engine. It was only necessary to attach water, fuel and air connections. The fuel system is simplicity itself. Individual Bosch fuel pumps for each cylinder and a Northern fuel transfer pump supplying fuel from the day tank. The engine is governed by varying the effective stroke of the pumps which are all connected with the Woodward type IC hydraulic relay governor through a common control shaft. A centrifugally actuated over-speed safety stop, driven from an extension of the cam-shaft, acts in case of emergency to stop the engine running away.

There are really two systems of lubrication on the engine: One is a circulating pressure system for the main bearings, crank pins, crosshead pin bearings, crossheads, governor, camshaft and other operating mechanisms. Texas "Algol" is used for this service. The other is a force feed system for the cylinders; here Texas "Ursa" is used through eight Manzel force feed lubricators, one for each cylinder, and timed through the drive from the camshaft.

The circulating pressure system is operated by pump located in the sump into which the oil drains after passing through the various parts. From the sump, the dirty oil goes through a Cuno Auto-Klean edge type filter, then into Schutte Koerting oil coolers, then through a basket type duplex strainer and on to a 'bus' rail inside the bedplate. A Goulds Hydroil Centrifuge operates on the lube oil system on a by-pass hook-up. All of this equipment, except the centrifuge, is located in a very well arranged cellar, under the main floor and at the sump end of the engine. Crane valves and fittings are used throughout this Nordberg installation — the whole piping layout is very compact, get-at-able and serviceable.

The handling of fuel for the entire plant has been worked out over a number of years to meet varying conditions. The present system consists of three 500-ton main storage tanks and two 100-ton day tanks. The plant is located in a valley behind Hamilton, some one and one-half miles from the dock, so a pipe line has been built to Hamilton Bay, with outlets to three docking berths. At the present time fuel is brought up from Trinidad by the Lady Boats (The Canadian National *S.S. C.* operates a fleet of passenger-freight boats on regular schedules through the British West Indies). These boats come through here about every two weeks and bring 160 to 200 tons of fuel at a time. The fuel itself is 23-24 degree Baume, quite light in color and works very well on all six engines. Fig. 3 gives a diagrammatic sketch of the fuel oil hook-up. From storage tanks to Goulds Hydroil Centrifuge then to large day tanks outside the building, then by pump to elevated day tanks, thence through a common header to all the day tanks in the power house itself, from which the fuel flows by gravity to the five Fullagars. In the case of the Nordberg, the engine's fuel transfer pump picks the fuel up from the day tank and delivers it under pressure to the Bosch fuel pumps. A duplex Nugent filter is installed on the discharge line between the fuel transfer pump on the Nordberg and the fuel suction header.

Exhaust temperatures are read by individual Foxboro distance reading thermometers mount-

One end of the power plant at Bermuda. This extension was recently added to accommodate the 3,180 hp. Nordberg

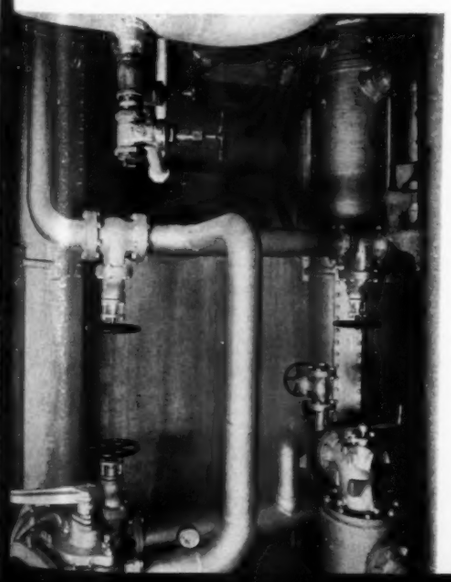
ed on the exhaust header. Motoco thermometers are used on the individual water outlets at the top of the engine and also for registering the temperature of the piston cooling oil for each piston. These permanently located instruments enable the operator to keep close check on the vital temperatures at all times.

Handling of the cooling water problem here typifies the common, horse sense which has been applied all through the layout and operation of this big plant. The water problem on the Island here is a tough one. Rain water is their only source of fresh water. Drilling of wells only produces brackish water. So they developed a simple, economical closed system consisting of six Weir heat exchangers of the condenser tube type, containing a total of 6,000 odd tubes, 18 gauge, 7 ft. long. Through these coolers, the jacket water of the engines is circulated and the coolant is supplied from a deep well pump outside the building circulating brackish water which averages 70-72 degrees as it comes from the pump. The corrosive action of this brackish water on the tubes has caused many a headache and eight different types of tubes have been tried in an effort to locate a formula which will resist the corrosive action of this water. These coolers are located in four spots in the plant and serve all engines; in other words, the piping layout permits using any cooler for any engine.

Air intake is through a battery of OC American Air Filters and thence through a Burgess intake silencer. The location of this plant, in a valley between two sets of hills, aggravated the intake air problem, but the installation of a Burgess intake silencer unit solved the problem in a very satisfactory manner.

Before I close, a word must be spoken of the men behind this plant—the daddy of the plant, the man who installed and ran the first 50 kw.

The cellar showing the two Schutte-Koerting oil coolers, the Cuno filter, Crane valves, etc.



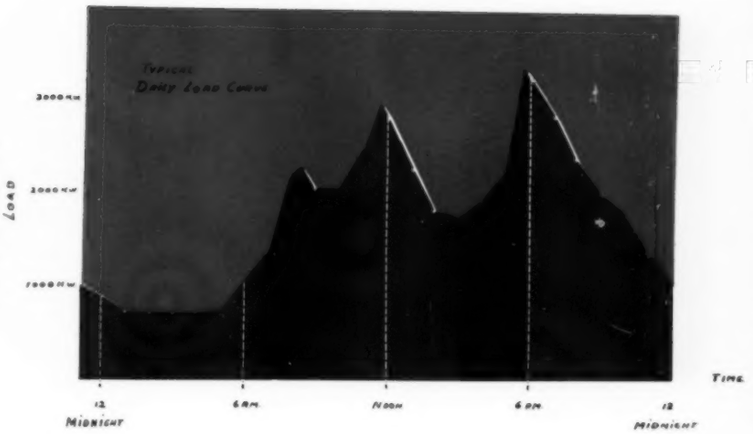


Fig. 1: This graph typifies the average load characteristics for the year ending June 30, 1939 — there is a remarkable balance between the day peak and the night peak, mainly due to the good merchandising of electrical apparatus amongst the consumers.

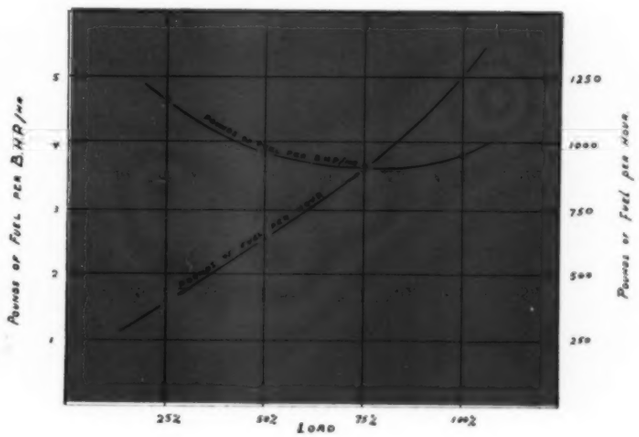


Fig. 2: This graph was worked out to show pounds of fuel per hour and pounds of fuel per bhp./hr. It covers the yearly period ending June 30 last.

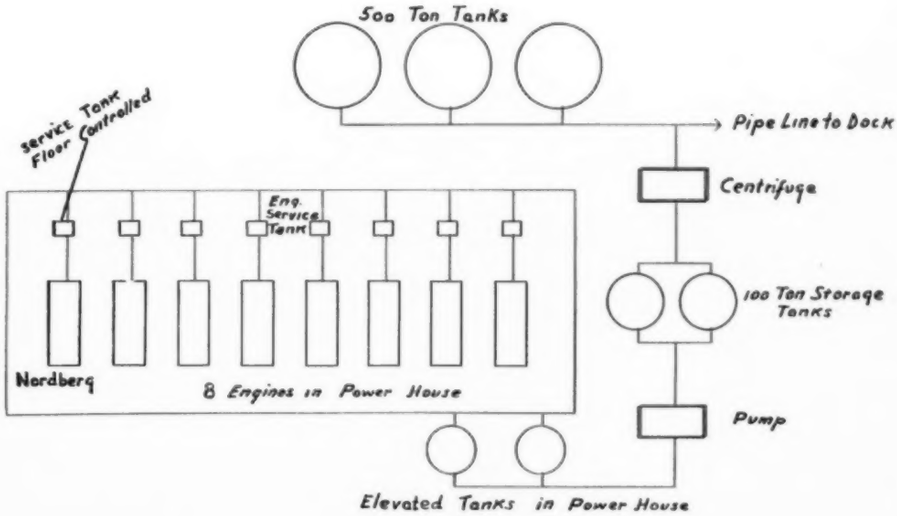
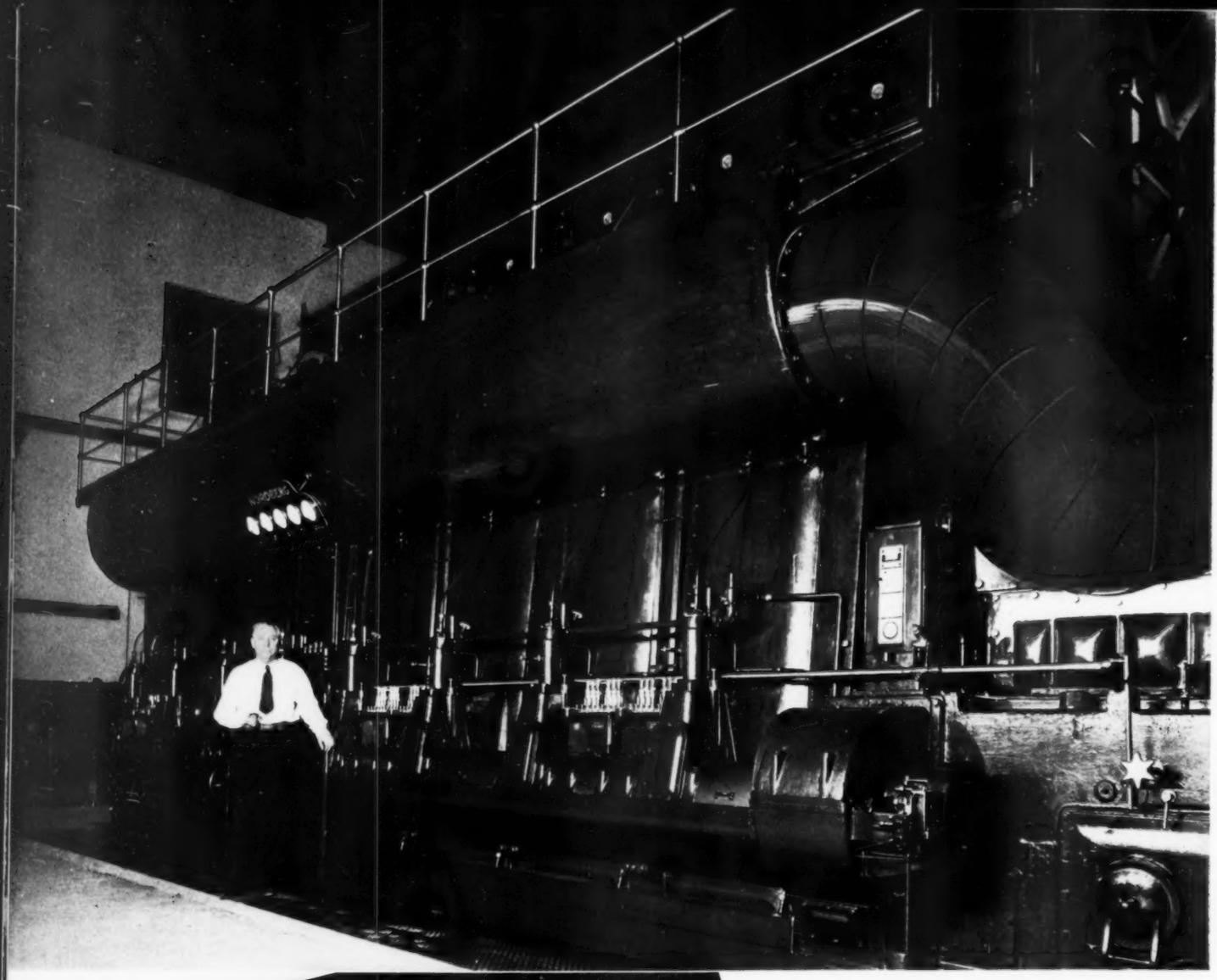
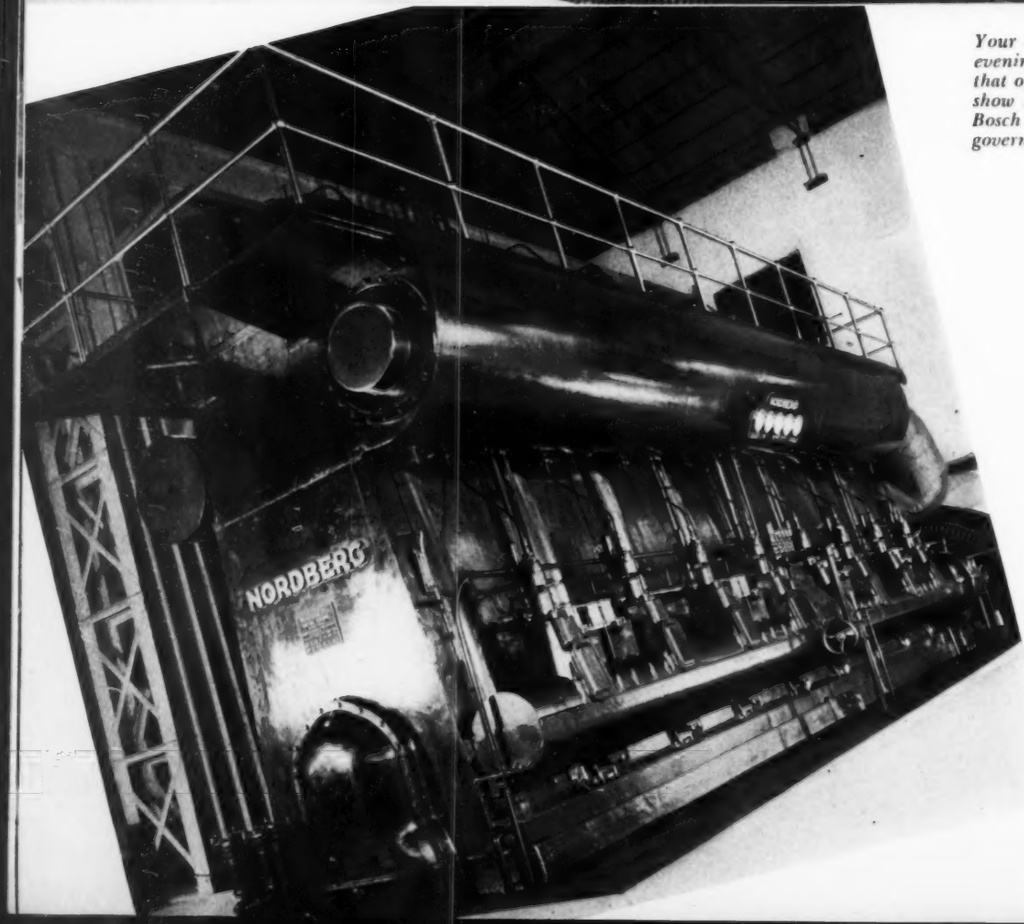


Fig. 3: A diagramatic sketch to show the flow of fuel oil from the docks down at Hamilton up to the main storage tanks and to each engine. The seventh and eighth engines shown in this sketch are small standby units not regularly used.





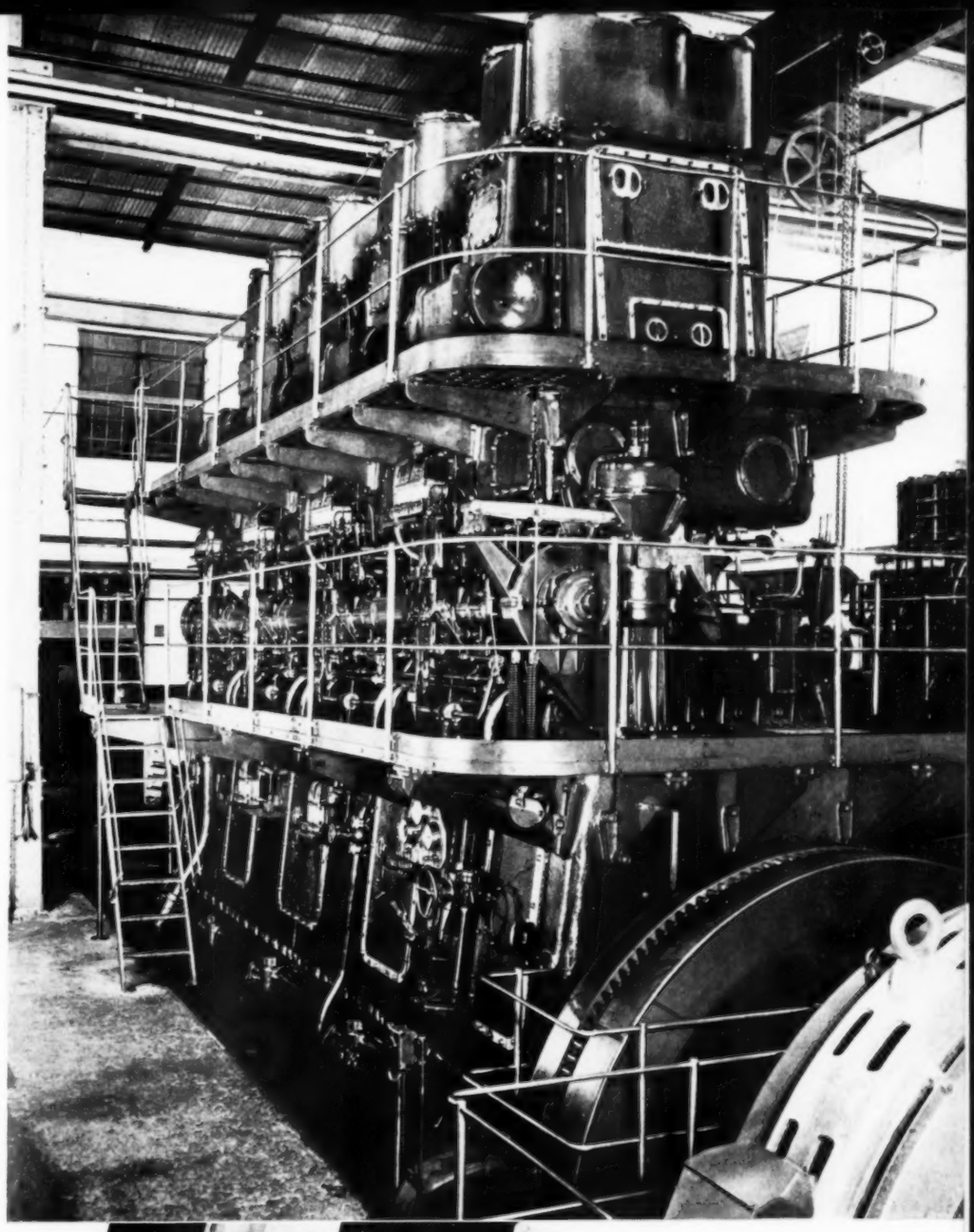
Your editor found the climate of Bermuda on the evening of January 1 a definite improvement over that of New York of the same night. These two views show the operating side of the big Nordberg. Note Bosch fuel pumps, Manzel lubricators, and Woodward governor.

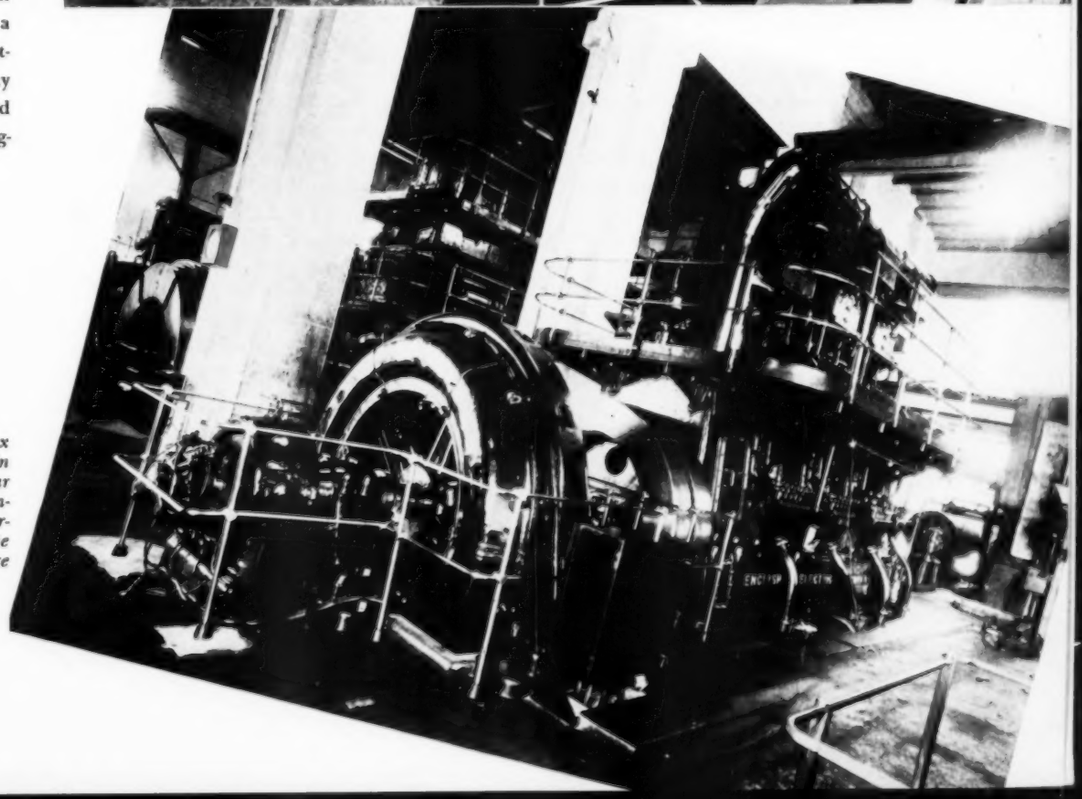
gas producer unit — H. G. W. Spurling, Superintendent Engineer, now 73 years old, active, keen-minded and wrapped up in his plant. Over 34 years of continuous service is his record here. He has seen the plant grow from a corner in a shed to its present splendid proportions and his has been the guiding spirit and the guiding hand. Self-taught, to a very large extent, Mr. H. G. W. Spurling is a mighty competent engineer: his plant testifies to that. He has an able assistant in Basil S. Seymour, A.M.I. Mech. E., who came over here from England in 1924 as the erecting engineer for the English Electric Company, to erect their second Fullagar unit. He never went back, he stayed on as assistant to the superintendent Engineer and a good job he has done of it. Naturally pretty keen about his five Fullagar

engines, he was a wee bit suspicious of the merits of this new Nordberg at first; in fact, he still holds some strong mental reservations, but he is fair, very fair, and the Nordberg is being given every chance to make good — and it will make good. In fact, I wouldn't be terribly surprised if a second 3,180 hp. Nordberg doesn't come over here some day to keep this first one company.

Now as touching costs and capacity: For the period ending June 30th, 1939, (before, of course, the Nordberg went on the line) the annual production was 14,216,054 kwh. The maximum peak during that year was 3,550 kwh. and the total rated capacity during the period was but 6,000 kw. Lube oil consumption worked out at 768 kwh. per gallon and the average production was 13.15 kwh. per gallon of fuel. The typical daily load chart is shown in Fig. 1. It is unusual to find such a nice balance between the day peak load and the night peak load. This is mainly due to the splendid merchandising of electric accessories under the general supervision of W. E. Spurling, the assistant manager. Mr. W. E. Spurling, M.A.I.-E.E., is a son of Mr. H. G. W. Spurling, the superintendent engineer, and, with over twenty-eight years of service, is doing a grand job of handling the business end of this large utility which has contributed so much to the growth of the Island's commercial activities.

No description of the Bermuda Electric Light, Power & Traction Co., Ltd., can be complete without mention of Sir Stanley Spurling, its managing director for twenty-six years. Despite the fact that Sir Stanley is, in effect, the Prime Minister of Bermuda and has tremendous responsibilities, he has directed and helped in the building up of this local and so vital a utility. With able, shrewd, well-trained assistants, Sir Stanley has made of this public utility one of the most efficiently operated in the world and consistently profitable, without overcharging the consumer.





Top: The 2,000 kw. eight cylinder, 19" x 22" English Electric Fullagar installed in 1937. Below: The first 750 kw. Fullagar installed in 1925. It is interesting to compare the simplicity and clean cut appearance of the Nordberg on the opposite page with these older and somewhat more complicated opposed piston units.

First of the C-3 combination cargo and passenger Diesel ships leaves the outfitting dock of the Sun Shipbuilding and Dry Dock Company at Chester, Pennsylvania, for her trial run.

"MORMACPENN"

First Maritime Commission C-3 Diesel Ship

THE first combination passenger and cargo Diesel ship to be completed under the Maritime Commission's revised plans for C-3 class cargo ships is the *Mormacpenn*. After successful trial runs January 11 and 12, she was tied up at the Sun Shipbuilding and Dry Dock Company's outfitting dock for finishing touches and will be in the service of Moore-McCormack Lines when this issue reaches you.

The revised C-3 cargo ship plans include cabins amidship for fifty-two passengers and certain other changes in the original C-3 design as suggested by shipbuilders and shipowners. The *Mormacpenn* has an overall length of 492 ft., a beam of 69 ft. 6 in. and a draft at full load of 27 ft. 3 in., a total displacement of 16,725 tons, and a deadweight capacity of approximately 10,725 tons. She is of the shelter deck type, all steel, single screw, making 16½ knots at 8,500 shp. Her normal crew will be seventy-six. The cargo space consists of three holds forward and two aft. Accommodations for fifty-two passengers are in the deck houses above the shelter deck. On the shelter deck are the galley, hospital, crews' lounges, messrooms and staterooms.

The general machinery arrangement on this, the first of the C-3 Diesel propelled combination cargo and passenger ships, includes four Busch-Sulzer 2,225 hp. main propulsion Diesels driving through Westinghouse electric couplings and Falk reduction gear to the single propeller shaft. Developing a total of 8,500 shp. at a propeller speed of 85 rpm., the main engines are capable of continuous operation at 10 per cent overload and two hours' operation at 25 per cent overload, a combination of motive power equipment sufficiently interesting to warrant detailed description later on in this article.

Now to delve into the construction and function of the Westinghouse electric couplings: The coupling consists of two elements, the outer element or field which is mounted on the reduction gear pinion shaft, and the inner element or armature, which is mounted on the engine crankshaft extension. The inner element consists of a steel spider fabricated from steel plates, formed to shape and welded together. The core is made of one piece circular punchings shrunk on the spider rim. The winding is a squirrel cage of bars driven into slots in the punchings and brazed to short-circuiting rings at the ends. The winding is generously proportioned to absorb the heat produced when the coupling is used to maneuver the ship.

In the outer element the poles are carried by a fabricated steel spider. The poles are of steel laminations, riveted together and bolted to the inside of the spider rim. The field coils are of copper strap wound on edge, and insulated with asbestos and mica. This type of field construction is the same as that used on most large generators and synchronous motors. The exciting current is brought in through brushes mounted on the gear case and bronze collector rings mounted on the field. The collector assembly is split for ease of assembly.

The electric couplings are controlled by one lever built into the centralized engine control station. This lever actuates a selector switch which operates the contactors in the control cubicle. The couplings get their excitation power from the auxiliary power bus and the control cubicle is located at one end of the auxiliary power switchboard. At the central control station, in addition to the selector switch there is an ammeter in each coupling field circuit and switches to cut out any coupling individually. The control is provided with interlocks to prevent energizing any coupling when the corresponding engine control is not in a running position and to prevent operation when the turning gear is engaged.

The selector switch has six positions marked Full Power, Half Power, Stop, Ahead, Stop, Astern. In the Full Power position, full excitation is applied to all couplings. In the Half Power position, the field current is reduced to approximately 70 per cent of the normal value. This is used when the ship is operated for long periods of time at low speed, 70 per cent normal or below, and reduces the heating in the field and increases the efficiency at these low speeds. In the Stop position, all fields are off. The positions marked Ahead, Stop, Astern are used in maneuvering as described below.

When maneuvering at low speed as in a close channel or when approaching the dock, two engines are operated continuously ahead and two astern. The propeller is controlled very closely by connecting it to the ahead or astern engines by moving the coupling control to Ahead or Astern. In the Off position between these, the propeller is disconnected from the engines. If at any time it becomes necessary to obtain full power in either direction, this can be done quickly by moving the engine controls to the proper point and the coupling control lever to Full Power.

The other case to consider is reversal from full astern as in a crash stop. Unless the torque available to reverse the engine is quite high, the propeller can be reversed more quickly by disconnecting the engines from the gears by

The two members which make up the Westinghouse electric coupling. Above — the inner member, which essentially is a steel spider on which is wound a squirrel-cage winding. Right — the external member, showing alternating-current excited salient poles.

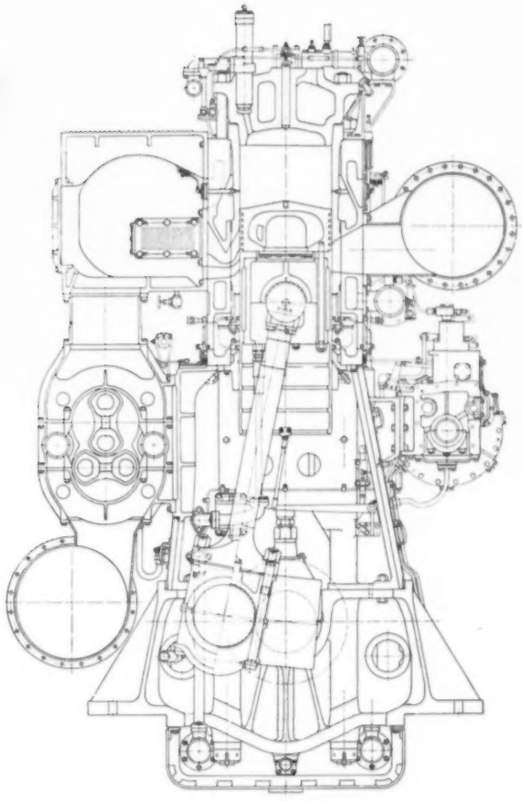
moving the coupling control lever to Off, reversing the engines separately and bringing them up to some reduced speed astern and then energizing the couplings by moving the lever to Full Power. When the couplings are de-energized, the engines are disconnected from most of the inertia in the system and will reverse very quickly. Then with the engines on fuel in the reverse direction, they can deliver full torque to reverse the coupling fields, gear and propeller. The couplings have enough torque at highslip to overcome the propeller torque. It is also possible to maneuver entirely with the engines, leaving the electric couplings excited so that the propeller follows the engines.

Returning now to the main propulsion engines: These are four Diesel marine engines of Busch-Sulzer Diesel Engine Company's standard design and manufacture. Each engine is 2-cycle, trunk-piston, mechanical-injection port scavenging and port-exhausting, air-starting, directly reversible, with attached positive displacement scavenging blower. The cylinders are seven in line, 20½ in. bore, 27½ in. stroke. The capacity of each engine is 2,225 bhp. nominal rating; 2,450 bhp. maximum continuous rating and 2,780 bhp. trial maximum rating.

In general, the engine proper consists of a base or bedplate, with seats for the main bearings, and supporting flanges for attachment to foundation; cylinder supports mounted on the bedplate; a cylinder-block, carried by these supports and in which are mounted the cylinder liners, or working barrels; tie rods to combine the base, supports, and block into a rigid structure; cylinder heads, carrying the fuel, starting, and relief valves; integral rotary scavenging blowers, gear-driven from the engine crankshaft; scavenging air receiver; exhaust header; pistons, connecting rods, and crankshaft; fuel pump; and operating gear. In conjunction with the frame, an oil trough and doors complete a vapor-tight enclosure for the moving parts.

On the back of the engine are the provisions for supplying the scavenging air, comprising a suction header, with opening for the air admission, surmounted by four rotary, positive displacement blowers, arranged in line extending substantially the full length of the engine; the blower impellers being driven, through gearing, from the crankshaft. The blowers deliver the air into a distributing chamber, or receiver, immediately above them and communicating with the interiors of the cylinders by way of the scavenging passages and ports. The blowers are fitted with reversible rotary valves for maintaining the direction of air flow when the engine is reversed. The exhaust header extends along the front of the engine.

The scavenging ports are in two tiers, around approximately one-half of the circumference of the liner; the exhaust ports in one tier around approximately the opposite half. Inside the bore of the cylinder, the tops of the scavenging ports in the upper tier are higher, and the tops of the scavenging ports in the lower tier are lower than the tops of the exhaust ports. In its downward travel, the piston first uncovers the upper tier of scavenging ports; but their communication into the scavenging air receiver is closed by automatic non-return valves. The piston next uncovers the exhaust ports, and, later, the lower tier of scavenging ports. On its return stroke, the piston closes these ports in the reverse order. The sequence of occurrences in the cylinders are:— towards end of the power stroke, pressure drop through the exhaust, to below the pressure of the scavenging air; scavenging through the upper ports and their non-return valves; scavenging through the lower ports; closing of lower scavenging ports; closing of exhaust ports; and continued charging of



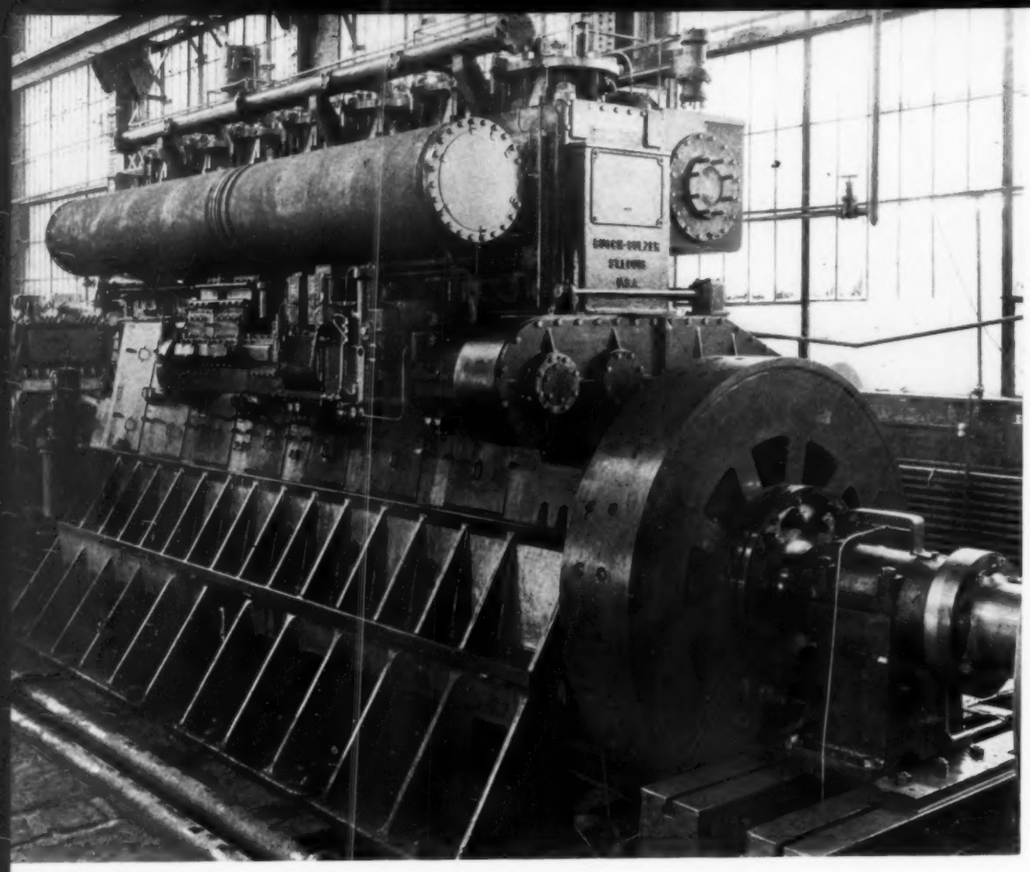
Cross section of the Busch-Sulzer 2-cycle trunk piston mechanical injection Diesel with integral scavenging blower.

combustion air into the cylinder through the upper ports until either the pressure in the cylinder equals the pressure in the scavenging air receiver, or the upper ports are covered by the piston.

The working pistons consist of three main elements; namely, a piston top, a skirt, and a wristpin housing. The forged steel piston top carries the piston rings and is cooled by the same oil as used for lubrication, the oil inlet and outlet being through telescopic tubes. The cast-iron skirt is a plain cylindrical body of light symmetrical cross-sections without any opening through its wall, through which lubricating oil from the wristpin could escape to the outside. The wristpin housing is attached to the piston top within the skirt, and transmits the piston pressure direcly to the wristpin, carried by the connecting rod, none of the pressure passing through the wall of the skirt. This housing provides a babbitt lined bearing for the wristpin, over the full length of the pin on its top or pressure side.

The fuel valves, mounted on the cylinder heads, are simple differential needle valves, hydraulically operated by the fuel pump pressure, the opening pressure being adjustable, the fuel being injected through Deco water cooled fuel atomizing nozzles.

The general lubricating system of the engine is



The 7-cylinder, 2,225 hp. Busch-Sulzer 2-cycle Diesel set up on the shop floor for tests with the electric coupling in place.

combined with the piston cooling system, to the extent that a single motor-driven oil pump serves both systems. The lubrication, of all except minor parts that require infrequent oiling, is by "force feed" method, using a Nathan distributor type lubricator. All return lubricating and piston cooling oil from the engine is gathered in a sump built into and part of the ship structure; but the oil from the respective systems does not mix until it leaves the engine, thus minimizing the accumulation of hot oil vapors in the crankcase. From the sump the hot oil is to be drawn, through a strainer, by the lubricating oil pump, and forced, through a filter and Ross cooler, back to the engine.

The main engines exhaust through a Foster-Wheeler combination direct-fired and waste heat boiler with Vortex spark arrester, which acts as a muffler as well as to supply steam for heating the ship. Each of the four engines is provided with its individual waste heat boiler section which assures best performance and greatest flexibility. If, for example, two engines should be operated and two idle, a very unsatisfactory condition would exist if the exhausts from two engines should be discharged into a single heating chamber carrying all of the heating surface for all engines. The velocity of the gases would be low and performance unfavorable. Likewise, if one or two engines should be shut down in order that work might be done on any of the elements in the waste heat section of the boiler, the other engines would also have to be shut down if a common gas chamber were used. Having a separate gas passage for each engine permits shutting down one engine in order to work on one gas passage and this in itself is a great advantage.

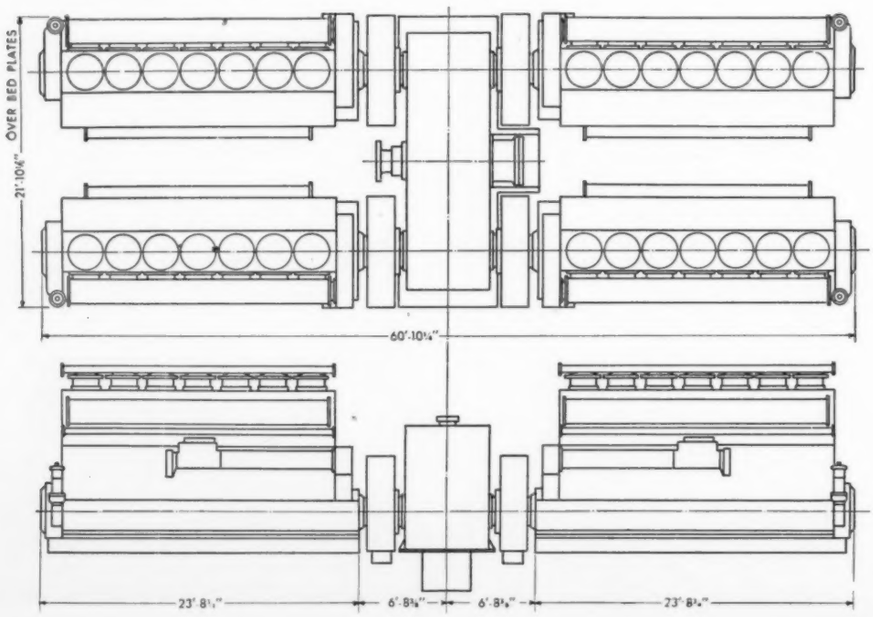
Mechanical details of the boiler include a steam drum 36 in. in diameter and approximately 16 ft. long, with connections to both the direct-fired and waste heat portions.

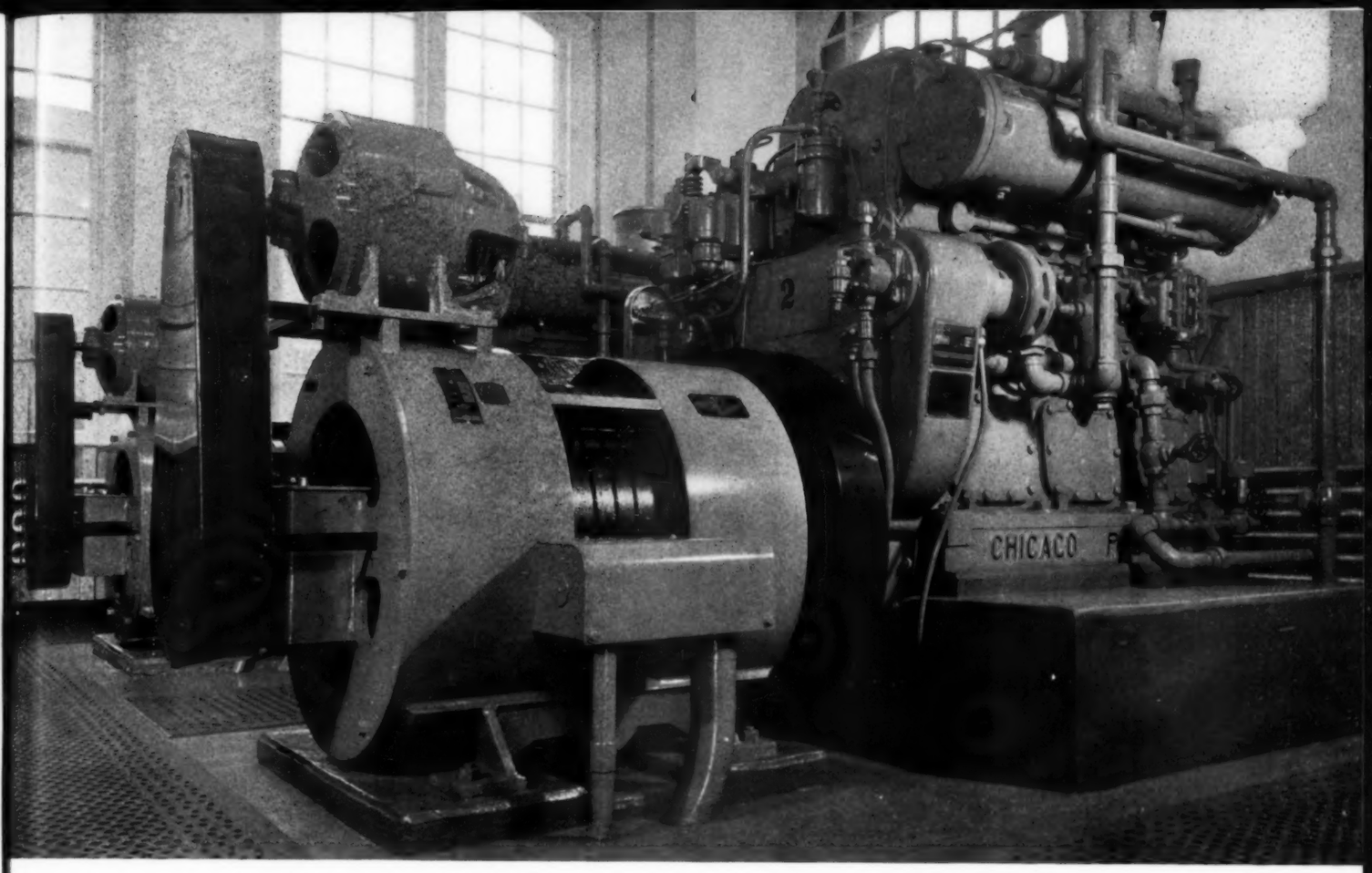
Four large Burgess Snubbers silence the intakes of the scavenging blowers on the main engines. The engine governors are Woodward Type S-I with overspeed trips. Four Ford two-ton Triblock chain hoists serve the main engines. The three starting air flasks are charged by two General Electric motor-driven Worthington compressors with Staynew intake air filters. Four Sharples Super Centrifuges handle all lube and fuel oil. Six Ross heat exchangers are installed in the closed fresh water Diesel jacket cooling systems. All engine room water valves are Chapman. The control station gauge board carries Marsh oil, water and air gauges, four Weston tachometers, one for each main engine, an Electric Tachometer master tachometer which shows cumulative shaft revolutions in addition to rpm., and an Alnor multipoint pyrometer with leads to the four main engine exhaust thermocouples.

Current for electrically driven machinery throughout the ship, for lighting and for the all electric galley is supplied by three Diesel-electric generating sets consisting of Cooper-Bessemer 5-cylinder, 12" x 15", 4-cycle, 400 hp., 450 rpm. Diesels direct-connected to General Electric 275 kw. 120/240 volt DC generators. These engines are equipped with Pickering governors, Purolator fuel oil filters, Andale lube oil coolers, and Fulton Sylphon lube oil pressure alarm switches. Each engine gauge board carries a Weston tachometer and Alnor seven point exhaust pyrometer.

The contract price of the C-3 cargo Diesel ships is $4,084,000 each. Contracts for four of these vessels were awarded to the Sun Shipbuilding and Dry Dock Company and the three ships to follow the *Mormacpenn* are now building at Chester, Penn.

Diagramatic top view and side elevation showing arrangement of four, 2,225 hp. Busch-Sulzer Diesels connected to one propeller shaft through Westinghouse electric couplings and Falk reduction gear.





General view of the two 112½ hp. Chicago Pneumatic Diesel generating sets at the Florence Dye Works, Woonsocket, Rhode Island. Few engine rooms are as clean and attractively decorated as this one.

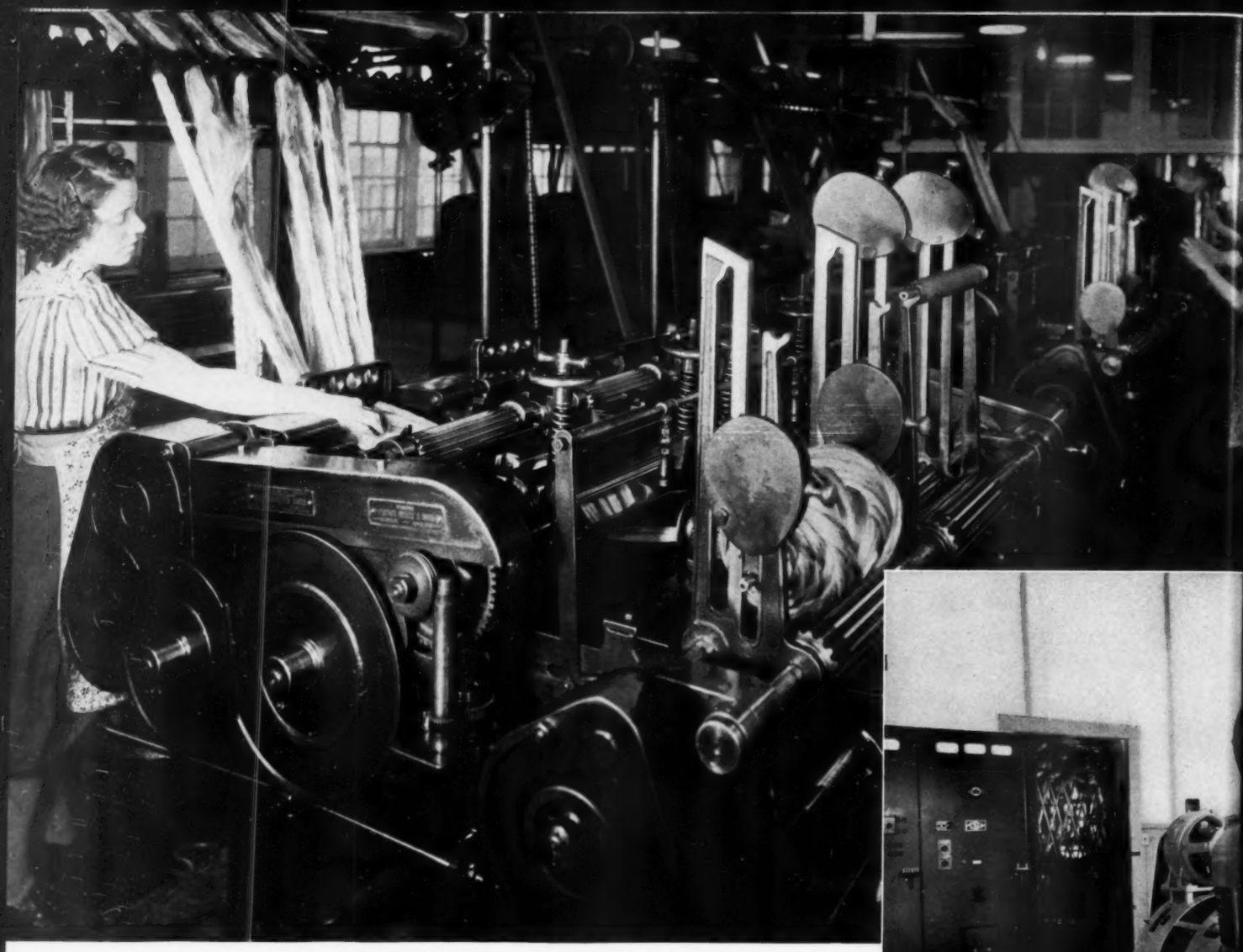
DIESELS FOR DYEING

BY GEORGE D. CROSSLEY

THIRTY THOUSAND suits a week could be made from the wool that normally passes through the Florence Dye Works of Woonsocket, Rhode Island. To dye this amount of worsted top, raw stock, silk, rayon or mohair requires almost a quarter of a million gallons of water every twenty-four hours, circulated by approximately forty centrifugal pumps. This takes power, and more power is needed for drying, blending and rewinding. In this industry, particularly, power must be thoroughly dependable since the process of dyeing should not be interrupted, and power must be economical to maintain high standards of workmanship at a fair profit in the face of keen competition. Since only the most modern methods and machines are employed by this company and its personnel are experts at their business, the cost of electric power for motor-driven equipment was the only item of fixed charges that could be reduced without affecting production. The cost of Diesel generated power is about one-half of local utility rates and its dependability has been established beyond all reasonable doubt. On the basis of proven savings amounting to fifty per cent of the electric power charge and with no sacrifice in reliability of power source, it is not surprising that the management decided to install a new Diesel plant, which has been in service operation since August 9, 1939.

The engines selected are two 3 cylinder, 4 cycle, Chicago Pneumatic Diesels rated at 112½ hp. each at 720 rpm. They are directly connected to two 75 kw. Electric Machinery Company alternators with direct current exciters mounted above them and driven from the shafts by Veelos adjustable V-belts. To consistent readers of DIESEL PROGRESS this method of mounting exciters is quite familiar since installation engineers are using it frequently to save space and make a more compact machinery arrangement. However, there is another very important advantage to be gained from this disposition of exciters, which is becoming more recognized. By removing this weight from the end of the generator shaft it is possible to eliminate the danger of a vibratory action that frequently manifests itself in the form of an unbalanced couple, which sets up a rocking action. Placing the exciter on top of the generator eliminates this unnecessary risk.

It is obvious from the illustrations that great



Diesel generated power is used throughout the plant to drive textile machinery. This department is blending wool of various colors to match samples supplied by yarn manufacturers.

care has been taken to make this engine room one of the most attractive in New England. Engine-mounted auxiliaries are typical of a plant of this kind and include Alnor pyrometers, Cuno and Nugent filters for lubricating and fuel oil, respectively, Harrison lubricating oil coolers and Burgess exhaust and air intake silencers. There is a Fulton Sylphon automatic control on the cooling water that maintains a discharge temperature of 145 degrees F. Viking safety controls are used also and sound an alarm when cooling water or lubricating oil volume drop below safe rates of flow. Other engine room equipment consists of the Electric Machinery Company dead-front switchboard and a motor-driven Quincy compressor for supplying starting air. The plant is entirely lubricated by Shell Talpa oil and operates on Shell fuel oil. Storage tanks of 4000 gallons total capacity insure ample fuel reserve for any emergency.

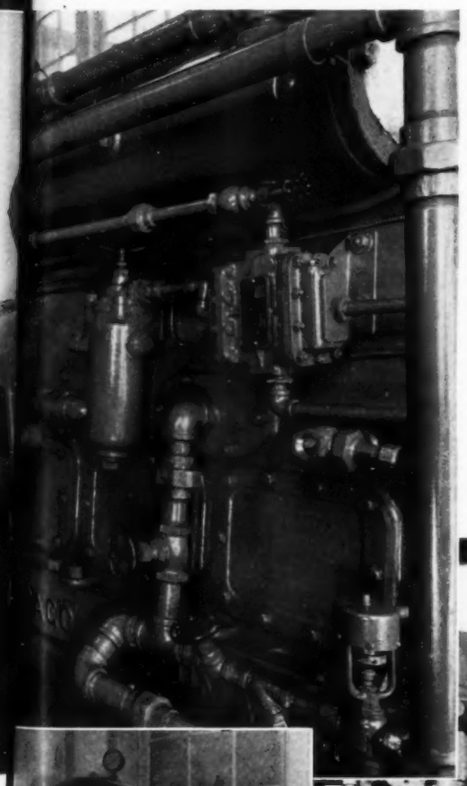
It is significant that no extra personnel was required for the operation of this Diesel plant. The company uses three low-pressure boilers to furnish steam for building heat, "boiling up" dye and heating drying drums, and Chief Engineer Peloquin and his crew of firemen have acquainted themselves with the operation of the Diesel plant with no difficulty. In addition to the saving in cost of electric power, the new engines effect further economies in boiler operation, particularly in the summer when there is no building heating load. Jacket cooling water from the Diesels is discharged at 145 degrees F. and piped into boiler make-up feed. The plant operates at 220 v. and the average load ranges between 90 and 120 kw. Thus, there is ample reserve capacity at all times and much of the time it is possible to operate on but one engine. The only utility stand-by service retained is emergency lighting in the engine and boiler room and pilot lighting for the night watchmen during week-ends when the plant is shut down. Normal power demand is on a five-day week basis and during the first five months of service each Diesel averaged 1200 hours. During this period operation has been more than satisfactory with no interruption in service of any kind.

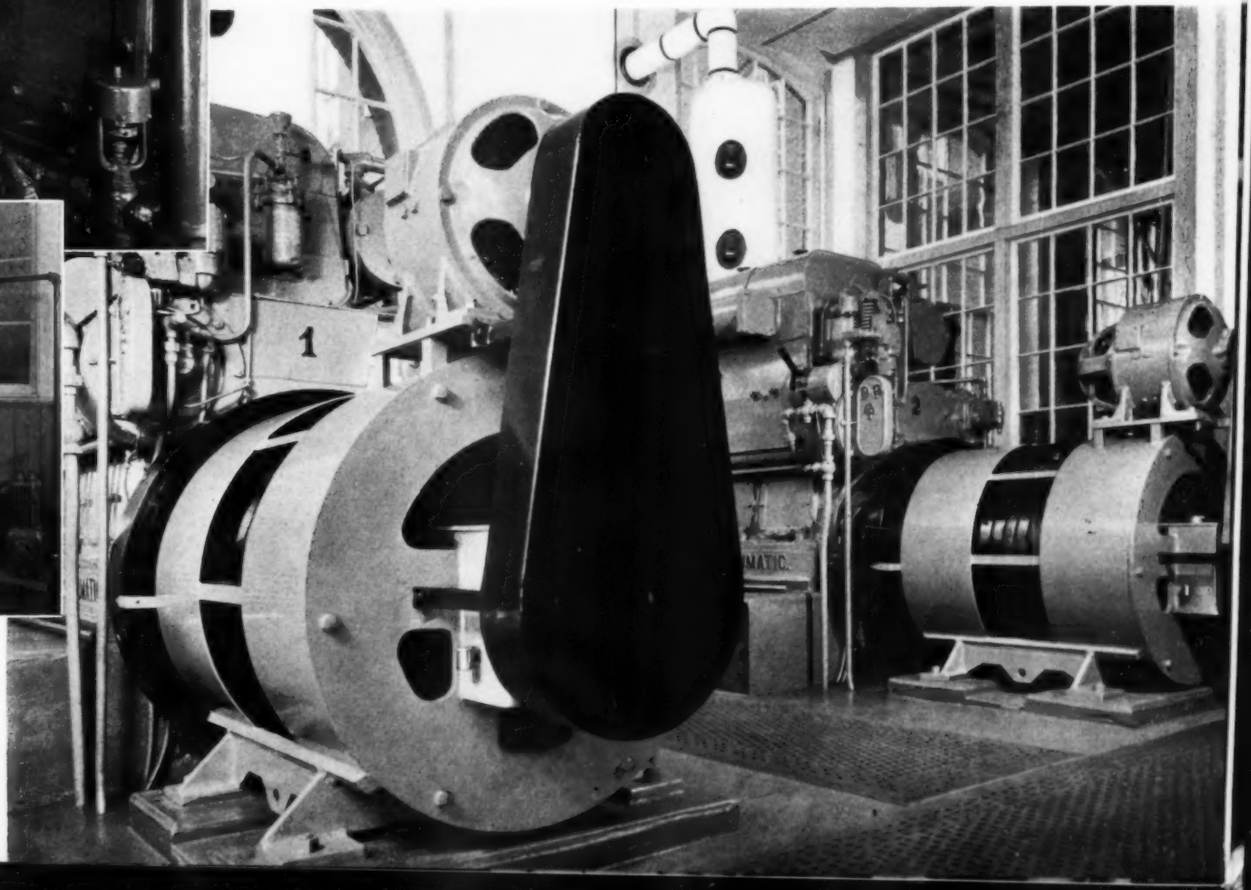
The Florence Dye Works is typical in many respects of other New England textile industries, but it is outstanding as the first of its type in its district to employ the economies of Diesel generated power. After thirty-five years of experience in this field Mr. Guerin, the president, is thoroughly familiar with all factors that enter into satisfactory service at profitable prices. Both he and Mr. Giguere, his assistant man-

ager, recognized in the Diesel an opportunity to reduce costs at the source of power without disturbing personnel or production arrangements. The new engines will pay for themselves out of savings within a few years, after which the difference in cost of electric current will become pure profit to the company. The confidence which both of these executives evidence in Diesel reliability can best be demonstrated by a brief description of the uses to which this power is put and the importance of continuous machinery operation in their plant.

Wool or other material to be dyed is received in loose rolls of approximately four pounds each, which are wrapped in cheese cloth to hold them together against the internal pressure of the circulating dye. These are placed on perforated spindles in the "kettles" and liquid dye heated to 180 degrees F. is forced through them from the inside out by motor-driven centrifugal pumps. Obviously, it is the responsibility of the Florence management to guarantee color specifications, which have been predetermined carefully in advance, and any interruption in the dyeing process would seriously affect finished results. After the dye has circulated sufficiently the rolls are unwound for drying. Special motor-driven machines accomplish this quickly and uniformly by carrying the long skeins of material over a succession of steam heated drums and steel rolls. Here again a steady flow of power is essential to efficient production in order to accommodate the discharge from the vats as fast as it requires drying.

In still another department, rolls of various colors are unwound, combed and blended into any color desired that cannot be achieved with dye, such as gray (a mixture of black and white) or heather (a mixture of many different basic colors). The French and domestic machines for this purpose are marvels of mechanical precision but rely for power upon electric motors suspended from the ceiling and connected by means of belt-driven line shafts. Thus, it is apparent from the foregoing that this plant is dependent upon a reliable source of electricity at virtually every point in its production line. It is equally obvious that this factor was weighed carefully by company officials before the final decision was made to convert to Diesels. Savings, however great, would be false economy without the definite assurance of dependability. Of course, to those familiar with the records of performance of isolated Diesel plants throughout the world in every conceivable type of industry, there is no longer any question on this point, but it is interesting to observe the conclusions of traditionally conservative New England business men after conducting their own investigation without benefit of local precedent. Out of fifteen dye works in and about Woonsocket, this concern is the first to avail itself of Diesel economy. This is a logical step in view of the consistently efficient management as illustrated by other equipment, methods and trade practice which have earned for it an enviable reputation in this segment of the great textile industry. Nor are the benefits of Diesel generated power confined only to the Florence Dye Works, since this transition will contribute materially to better service to customers with the control of power no longer subject to floods, storms or other previously unavoidable interruptions.





Left – Exhaust side of the No. 1 engine with the Electric Machinery Company switchboard in the background. The doorway leads to the boiler room where process steam is generated.

Lower Left – Close-up of the motor-driven Quincy compressor and storage tank for starting air.

Below – Direct current exciters are conveniently mounted on the Electric Machinery Company alternators. The control station for the No. 2 engine appears in the middle background.

This view of the "Jane" and "Marion" on the ways reveals the hull lines specially designed for the Kort Nozzles. Left — View looking to port and aft in the wheelhouse.

DIESEL HARBOR TUGS "JANE" AND "MARION"

By WILBUR W. YOUNG

EMBODYING many noteworthy "firsts," the *Jane* and *Marion*, by all comparisons the most pleasing tugs to look at, joined the Curtis Bay Towing Company's Silver Fleet last December. These are the smallest craft ever built by The Pusey and Jones Corporation but, under propulsion of their Enterprise, 6-cylinder, 320 hp. Diesel engines and due to other "first" design features they pack a surprising wallop. Their operators characterize them as "miniature giants."

These are the first vessels in the United States to employ the patented Yourkevitch hull form; the first towboats to have been especially designed for Kort Nozzles. These features contribute to the unusual efficiency developed in trials and coincidentally render these craft the most seaworthy of the "Silver Fleet." The patented lines permit these boats to proceed at full speed with a minimum of undesirable wave formation and without the characteristic stern squat of towboats. In spite of the additional wetted surface of the Kort Nozzle, as a submerged appendage, it is remarkable that these boats, with a loaded displacement of 106 tons and a relatively large beam of 18 ft. 9 in. with respect to a waterline length of 63 ft., develop twelve miles per hour on 320 hp.

According to E. A. Hodge, marine manager of The Pusey and Jones Corporation, who prepared the specifications and type plans for these tugs, the Bollard tests by dynamometer demonstrated that they develop a towing pull of 13,000 pounds as compared with 8,900 pounds usual from tugs of this size and power that are not equipped with the Kort Nozzle. The towing pull thus produced is equivalent to 502 shaft horsepower, which is comparable to a step-up in towing efficiency of 47½ per cent; that is to say, the fuel consumption when towing at full power undergoes a sharp reduction on the pounds-of-fuel-per-knot basis.

The tugs *Jane* and *Marion* are identical in design and fitting. Their length is 74 ft., breadth 18 ft. 3 in. and draft 6 ft. 6 in. Main propulsion engines are Enterprise, 4-cycle, 6-cylinder, 12" x 15" Diesels developing 320 hp. at 320 rpm. The engines are started and reversed by a built-in Chicago Pneumatic air motor. Complete control of the engines from the steering wheel is provided for through remote control supplied by the engine builder.

Pistons are fitted with American Hammered rings, the valves are Jadson and main bearings are Satco. Built-in accessories include Manzel

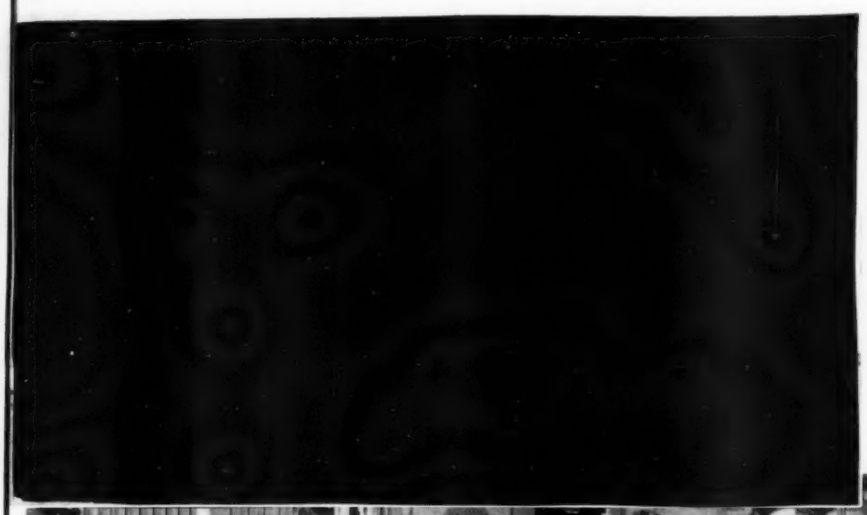
force feed lubricators, American Bosch unit fuel injection system, Purolator fuel oil filters and Gardner Denver air compressor. A Star 5 kw. DC generator is belted to the engine flywheel for lighting and electric auxiliaries while the main engine is operating.

Maxim spark arrester type exhaust silencers for both main and auxiliary engines are mounted in the stack. Weston electric tachometers show engine rpm. on the engine room gauge board and in the wheelhouse. Lube oil reclamation is handled by De Laval model 35-13 industrial type centrifuges. Lube oil is cooled by externally mounted Harrison heat exchangers. The engines are served by Wright ½-ton, overhead chain hoists with Hyatt Roller bearing trolleys.

The standby battery is a 56-cell, 200 amp. hr. Exide Ironclad. The John Reiner auxiliary unit, mounted forward of the engine, is made up of a Stover, single cylinder, 15 hp., 4-cycle, full Diesel, a Star 5 kw. generator and a Gardner-Denver air compressor.

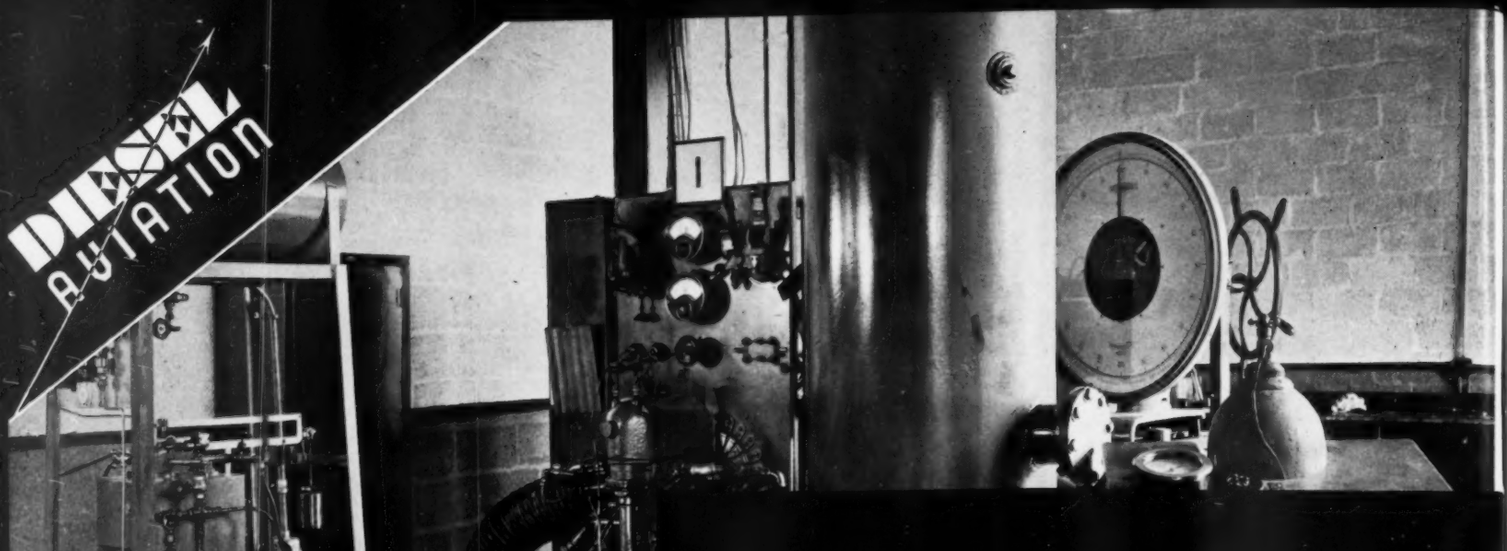
The all-welded hulls and the main machinery were built to the highest classification and were subject to inspection of the American Bureau of Shipping. The ⅜ in. steel shell plating is welded throughout as well as the decks and superstructure.

During the trial run of the *Marion*, the second of the pair to be delivered, the exceptional planning of space utility was most noticeable. With a heavy sea running, the decks were deserted while the twenty-eight persons aboard were distributed in wheelhouse, galley and machinery space without crowding. Much credit is due the builders for the pleasing — almost yacht-like — appearance of these work boats. The concave stem line, the all silver superstructure, the squat, rakish stack with blue scarf, and even the bronze name plate on the wheelhouse all express the fine thinking applied throughout the design and construction of these history-making tugs.



Engine room view showing control station of the Enterprise Diesel propulsion engine forward. Note Weston tachometer top of engine gauge board.

DIESEL AVIATION



A 2-stroke, water-cooled Diesel test engine set-up in the N.A.C.A. engine laboratory at Langley Field.

DIESEL AIRCRAFT ENGINE RESEARCH BY THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS – PART II

By PAUL H. WILKINSON

LANGLEY FIELD, Va., December 14. In addition to research work with 4-stroke air-cooled and water-cooled Diesel test engines, the writer found on his recent visit to the N.A.C.A. laboratories at Langley Field that experiments were also being conducted with a 2-stroke Diesel test engine. This engine had a water-cooled cylinder having a bore and stroke of 4.625 in. and 7.00 in. respectively, and a displacement of 118 cu. in. The arrangement of the air intake ports toward the bottom of the cylinder and the four poppet exhaust valves in the cylinder head, permitted straight-through scavenging with good air loading. Supercharging was provided by means of an independently-driven Nash blower equipped with a surge tank.

Tests with this engine showed that it had a power output of 70 hp. at 1,800 rpm. with a boost pressure of 8.1 lb. per sq. in. This is equivalent to a bmep. of 132 lb. per sq. in. and a specific output of 0.59 hp. per cu. in. of displacement. By increasing the boost pressure to 10.0 lb. per sq. in., a net power output of 86 hp. was obtained at the same rpm. In this instance, the bmep. was 160 lb. per sq. in. and the specific output was 0.73 hp. per cubic inch.

Optimum performance with this engine was obtained with an air entry angle at the ports of 60 degrees in the horizontal plane and zero degrees in the vertical plane. The performance was found to be adversely affected when the entering air was deflected upward through the ring of ports. The fuel consumption during these tests was 0.45 lb. per hp. per hr. at three-quarter load with 90 per cent excess air. These items were considered to be excessive and the engine was being redesigned with a sleeve valve

to give it better combustion characteristics and reduce the load on the valve gear so that higher operating speeds could be attained.

Experiments have also been conducted by the N.A.C.A. which give some indication of what may be expected in the way of performance of a supercharged Diesel aircraft engine at an altitude of 19,000 ft. For these tests, the 4-stroke, water-cooled, single-cylinder Diesel test engine described in Part I of this article was used. This engine had a bore and stroke of 5.00 in. and 7.00 in. respectively, and a displacement of 137 cu. in. The cylinder head had one inlet and one exhaust valve and the compression ratio was 14.5 : 1.

Inasmuch as a regular altitude chamber was not available, the temperature of the incoming air was reduced to a temperature of −35°F. by cooling it with cakes of solid carbon dioxide. Although the surge tank connected to the intake air blower and the connections to the air intake in the cylinder were well lagged, by the time that the air reached the cylinder its temperature had risen to −3°F. due to the absorption of heat from the surrounding air. A Roots blower was used to evacuate the exhaust tank at a pressure corresponding to the altitude simulated for the test.

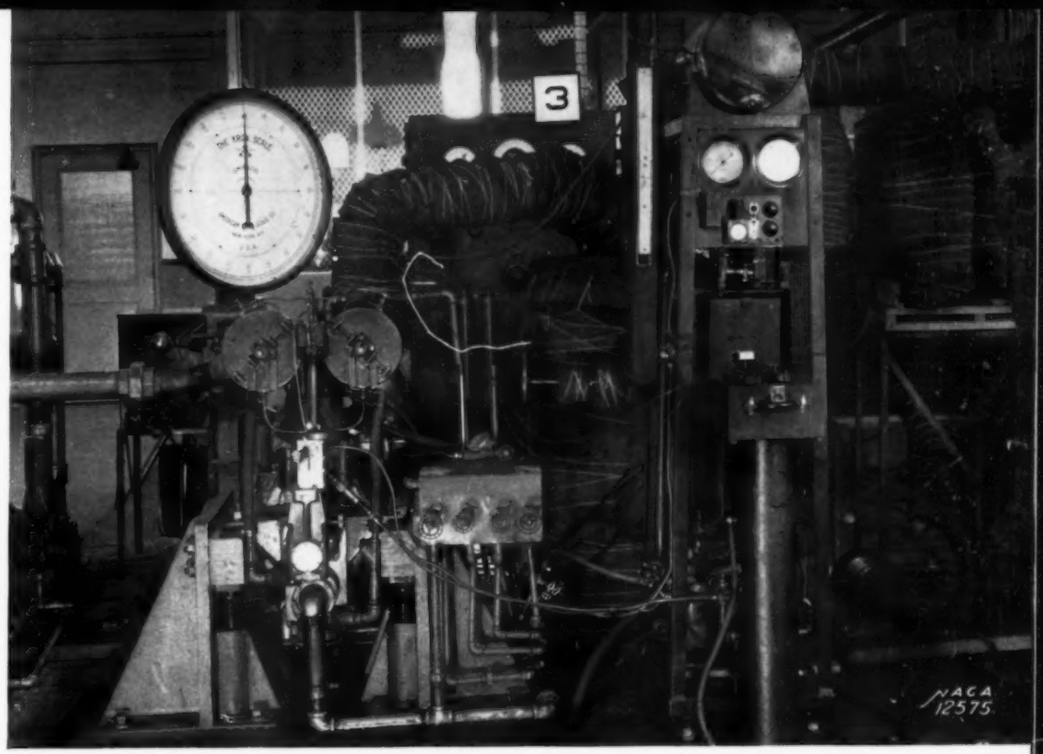
With an engine running at a speed of 2,000 rpm. with the inlet air at a temperature approximating that found at an altitude of 19,000 ft., the power output was 55 hp. with a boost pressure of 2.4 lb. per sq. in. This is equivalent to a bmep. of 158 lb. per sq. in. and a specific output of 0.40 hp. per cu. in. By increasing the boost pressure to 7.4 lb. per sq. in., the power output was increased to 63 hp. corresponding to a bmep. of 182 lb. per sq. in. and a specific output of 0.46 hp. per cu. in.

So far, experiments at the N.A.C.A. laboratories in the 2-stroke field have been confined to water-cooled test engines on account of the cooling problems involved with the 2-stroke Diesel. It seems that the more frequent generation of heat due to the more frequent power strokes in the 2-stroke engine are more easily coped with in this way. Recently, however, the N.A.C.A. have developed a new type of cooling for air-cooled cylinders which may prove to be a solution to the problem of air-cooling a 2-stroke Diesel aircraft engine.

On this new cylinder, a method has been found for bonding a large number of thin, pre-formed sheet aluminum cooling fins to the aluminum alloy cylinder head. This construction removes all restrictions which hitherto have governed the cooling areas of cylinder heads and makes possible considerable increases in power output. Tests already completed show that the new N.A.C.A. closely-spaced fins will cool a cylinder when it is developing approximately three times as much power as an air-cooled cylinder constructed along conventional lines.

Not only the cylinder head, but the cylinder barrel as well has been subjected to these increases in cooling area. It is obvious, of course, that this part of the engine must also have its temperature reduced if piston ring troubles are to be avoided and more power is to be taken from the cylinder. For the cylinder barrel, the preformed cooling fins are made of thin sheet steel and they are brazed onto the steel barrel.

The characteristics of some of the single-cylinder test engines which have been used by the N.A.C.A. to determine the approximate performance of Diesel aircraft engines, are shown in the accompanying tabulation. Now that the problems of the 4-stroke, air-cooled Diesel have been solved in a satisfactory manner, it appears to be highly probable that the problems of both air-cooled and water-cooled 2-stroke Diesels will be solved in like manner. Beyond a doubt, excellent work has been done by the N.A.C.A. and their comprehensive development program should do much to hasten the advent of the Diesel aircraft engine in the United States.



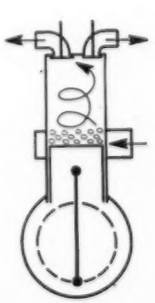
An engine set-up for simulated altitude tests with a 4-stroke, water-cooled Diesel test engine.

CHARACTERISTICS OF SOME N.A.C.A. SINGLE-CYLINDER DIESEL TEST ENGINES

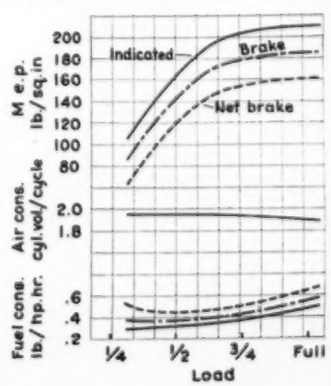
Cooling system	Bore in.	Stroke in.	Displacement cu. in.	Power output h.p.	Power output r.p.m.	Boost lb./sq. in.	B.m.e.p. lb./sq. in.	H.p. per cu. in.
4-STROKE CYCLE ENGINES								
[1] Air	5.00	5.50	108	55	2,250	7.5	180	0.51
[1] Water	5.00	7.00	137	86	2,500	10.0	200	0.63
[2] Water	5.00	7.00	137	55	2,000	2.4	158	0.40
[2] Water	5.00	7.00	137	63	2,000	7.4	182	0.46
2-STROKE CYCLE ENGINES								
[3] Water	4.62	7.00	118	70	1,800	8.1	132	0.59
[3] Water	4.62	7.00	118	86	1,800	10.0	160	0.73

[1] Corrected to multi-cylinder engine performance.
[2] Single cylinder net performance at simulated altitude of 19,000 ft.
[3] Single cylinder net performance.

Diagram of the N.A.C.A. 2-stroke Diesel test engine showing the arrangement of ports and valves for straight-through scavenging.



N.A.C.A. 2-STROKE-CYCLE DIESEL ENGINE
4 5/8 IN. BORE X 7 IN. STROKE 1800 R.P.M.



The Pilot Boat "Maryland" recently converted from steam to Diesel propulsion. The new main engine is a 600 hp. Atlas Imperial Diesel and auxiliary power is furnished by two 20 kw. Hill Diesel generating sets.

PILOT BOAT "MARYLAND"

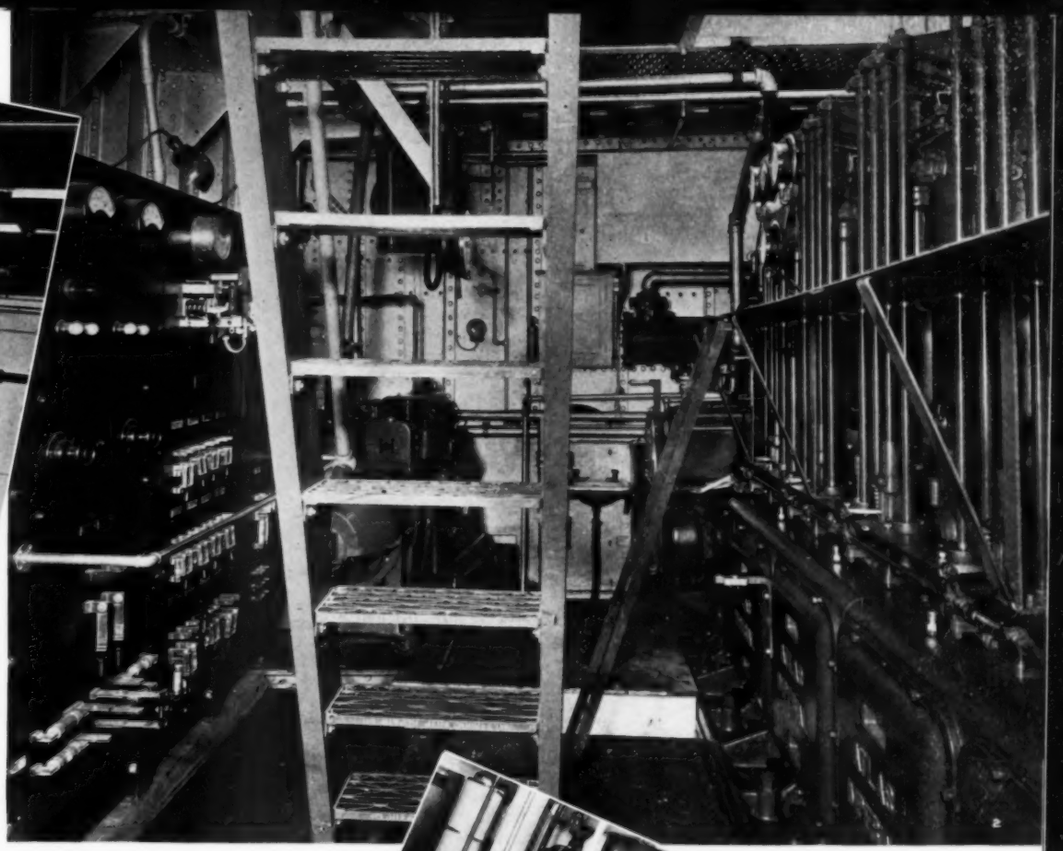
Diesel Conversion Permits Five Months' Service Without Refueling

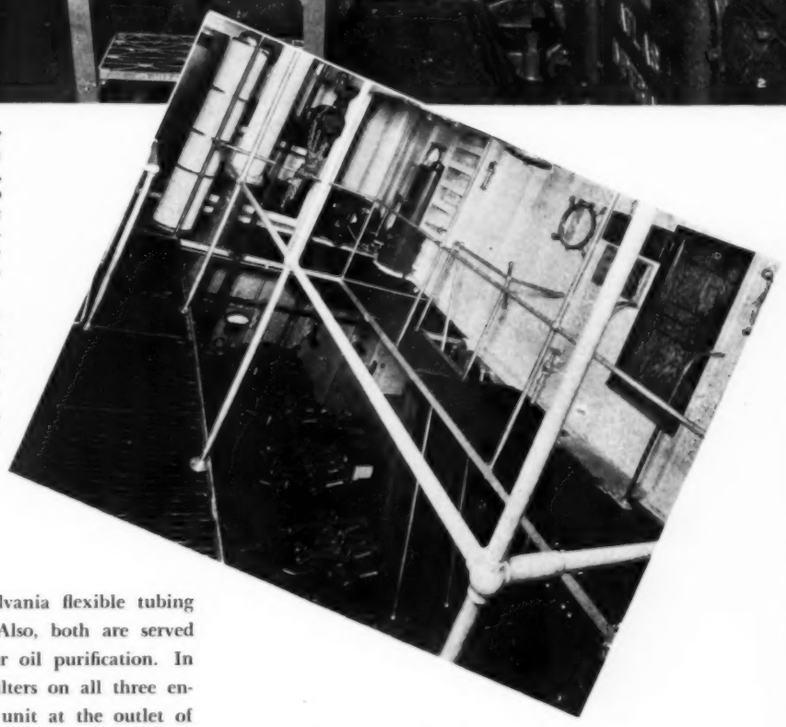
CONSIDERING its vital importance to maritime commerce, the Association of Maryland Pilots is not recognized as widely as it deserves. This is not strange since the members of that organization are inclined to avoid publicity rather than seek it, and devote their interests to maintaining the high quality of expert, dependable service that was initiated over fifty years ago. To the Masters and deck officers of the thousands of passenger and cargo vessels that pass the Virginia Capes each year, en route to and from Chesapeake ports, these men are familiar and welcome, and the satisfaction of duty performed regardless of weather conditions is beyond that of public acclaim. However, devotion to duty in the pilot service, as in all other marine activities, must be complemented with a dependable ship and equipment, and the story of the *Maryland* will be of interest to all ship owners who face similar problems of seaworthiness, dependability and operating economy.

The *Maryland* is one of two ships owned by the Association, which consists of forty-two member Pilots. The vessels are alternated in active service periods of approximately five months so that one is always on duty while the other is laid up for overhauling and routine maintenance, after which it is available for emergency standby service. During each term at sea the ship cruises slowly off Cape Henry to place pilots aboard incoming ships and take them off those outward bound. As many as forty transfers may be necessary during one week-end, which indicates the constant maneuvering demanded of a vessel in this service. During the five months "on station," the pilot boat never touches shore except to take on fresh water and this must be done quickly so as not to miss a single ship. Under such conditions the importance of maximum cruising capacity is obvious. Food for the crew of fourteen and those pilots resting on board between assignments is sent out to eliminate the necessity of leaving the "station." Few, if any, vessels are required to maintain such uninterrupted service for so long a time where the consequences of failure would be so far reaching in their effects upon commerce. Always striving to improve service and seeking maximum operating economy consistent with dependability, the Association recently completed repowering of the *Maryland*. In view of the stringent demands of this unique type of service, their action is of considerable interest.

Control station of the Atlas Diesel which replaced steam propulsion in this well-known ship owned by the Association of Maryland Pilots. A Weston tachometer appears on the gauge board and one of two Liquidometer remote reading fuel tank gauges can be seen on the forward bulkhead.

The *Maryland* was originally designed as a steam trawler in 1918, intended for delivery to the French Government. After the armistice was signed work was suspended and the boat was not finished until 1922 when she was purchased for her present service and completed by Todd Shipyards Corp. Principal dimensions are : l.o.a. 140′; beam 25′; and draft 12′ with a displacement of 398 gross tons. Obviously, trawler lines are particularly well suited to coastwise cruising in all conditions of weather and sea. During the years of her steam operation marine Diesels were finding increasing favor, especially for ships of this size, and their characteristics of fuel economy and cruising range assumed major importance to the Association compared with coal-fired steam when the time came for repowering. Accordingly, by a ballot of the members, which is the way such questions are decided, the contract for conver-





Above—Looking aft on the starboard side we see main engine control station, switchboard, one of two Hill Diesel generator sets mounted on Korfund Vibro-Dampers and the Ross heat exchanger in the closed cooling system.
Right—Upper engine room view on board the "Maryland" looking down on the new Atlas Diesel. The equipment on this deck includes the Yale hoist, Goulds Hydroil and Prestolite batteries.

sion was awarded to the Baltimore Marine Repair Shops under the supervision of Mr. O. C. Chapman, Naval Architect, and the order for machinery was placed with the Fleck Engineering Company, also of Baltimore.

The main propulsion engine selected is a heavy-duty, 6 cylinder Atlas Imperial Diesel rated at 600 hp. at 300 rpm. It is directly connected through a Kingsbury thrust bearing to an 82" by 52" three blade Columbian bronze propeller. Engine-mounted auxiliaries include a Weston electric tachometer, Purolator and Cuno filters for lubricating and fuel oil, respectively, and a Madison-Kipp lubricator for the cylinder walls, as well as the customary pumps, pressure gauges, etc. Exhaust temperature is registered by an Alnor pyrometer. Auxiliary power is supplied by two 20 kw. Hill Diesels mounted on Korfund steel spring Vibro-Dampers. These units, turning at 1200 rpm., drive 115 v. DC General Electric generators. Floating on the line are 110 v., 450 amp./hr. Prestolite marine type batteries to assure a steady flow of current at all times. Both main and auxiliary Diesels exhaust through Pennsylvania flexible tubing into Maxim Silencers. Also, both are served by a Goulds Hydroil for oil purification. In addition to Cuno fuel filters on all three engines there is a similar unit at the outlet of the day tank to insure nothing but clean oil reaching the spray nozzles. A motor-driven Viking pump is used for oil transfer from the 13,000 gallon tanks. Two Liquidometer tank gauges give constant remote readings of fuel supply. A larger Viking pump serves bilge, fire and general service lines. Fresh water cooling is supplied by a Ross heat exchanger, which is fed salt water by a 3" Weinman reversible centrifugal pump, belt-driven from the tail shaft. In addition to the regular engine-mounted air compressor there is a motor-driven Curtis compressor to supply starting air to six 24" x 84" Scaife tanks mounted forward of the engine room bulkhead. These are so arranged that ample pressure is maintained at all times despite the unusual demands for maneuvering. In this connection the Smola electric steering gear is of particular interest. The cable drum is motor-driven through a system of gears and may be operated at the wheel or by push buttons on either wing of the bridge. This enables the helmsman wide latitude of movement to observe his vessel's position while coming alongside other ships, and is invaluable for pilot service. On trials only 15 seconds were required from "hard over" to "hard over." For

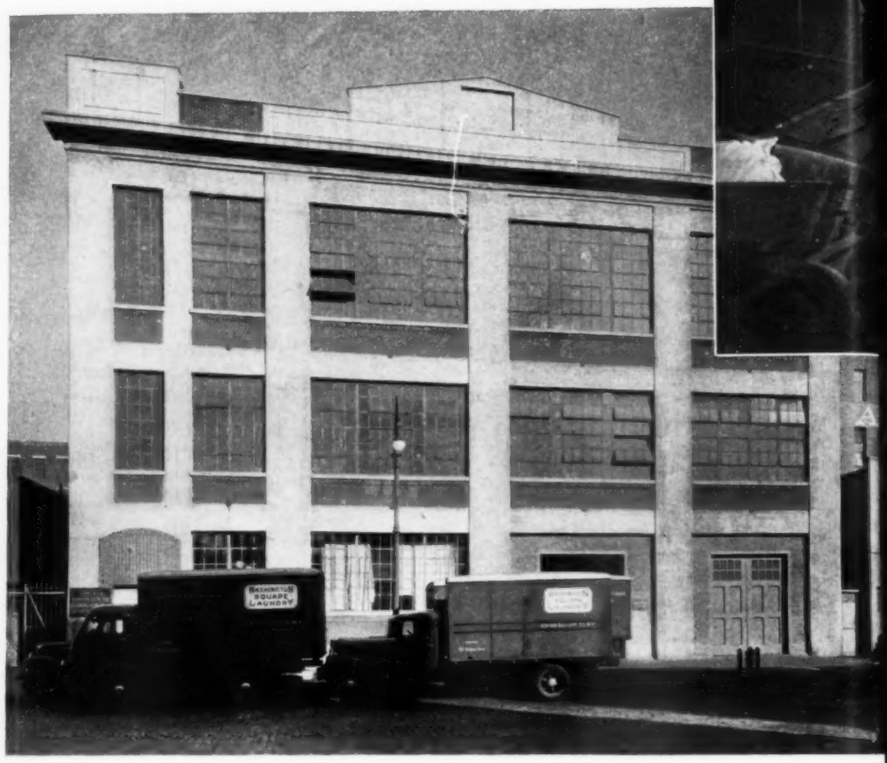
. . . . *And now please turn to page 57*

WASHINGTON SQUARE LAUNDRY

DIESEL engines in laundries are certainly no longer news throughout the United States, where this economical form of power has enjoyed wide and enthusiastic acceptance despite the heavy demand for process steam in the business of washing the nation's clothes. The almost universal use of electrically driven washing machines, ironers and other electric equipment produces a power demand in excess of many steam plant capacities when added to the original steam demand for washing and drying, at least during periods of peak loads. Since the expense and inconvenience of increasing boiler capacity is seldom justified, laundry owners have generally contracted for utility standby service until ever-increasing loads warranted the installation of more economical Diesel generating sets.

The Washington Square Laundry, Inc., at 429 East 23rd Street, New York City, is no exception to the above rule. As business increased, both electric and steam demands rose in proportion to a point where it was no longer profitable to generate peak load current with the steam generating units installed. Further increases forced power consumption still higher, particularly on Tuesdays, Wednesdays and Thursdays, until it became obvious to Chief Engineer Andreassen that substantial savings could be effected by eliminating standby purchased power in favor of a Diesel. The management concurred with his report in view of high electric bills and overloaded boilers and approved the purchase of a Chicago Pneumatic, 4-cylinder unit rated at 150 hp. at 720 rpm. As shown by the illustration, the installation was a simple one with practically all auxiliary equipment engine-mounted. All that was necessary in addition to the integrally connected engine, generator and exciter were a small switchboard, fuel tank and Levelometer remote reading tank gauge, a Curtis compressor and a small tank for starting air. All were conveniently located in a previously unused corner of the engine room.

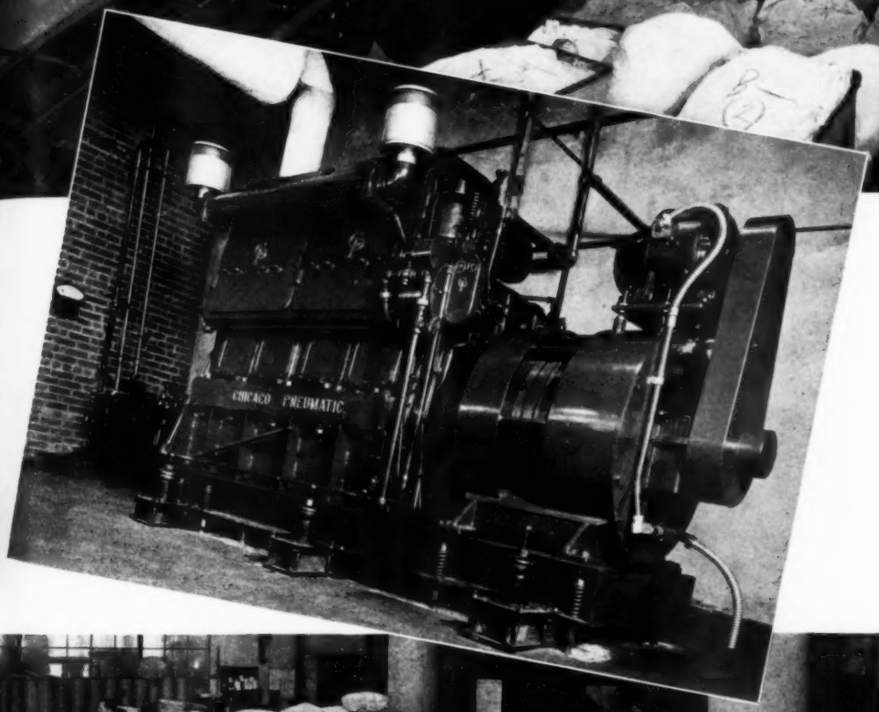
Other equipment vital to efficient and trouble-free operation includes Nugent and Cuno filters for fuel and lubricating oil, respectively, an Alnor exhaust temperature pyrometer for maintaining balanced cylinder loading, a Harrison lubricating oil cooler, Burgess intake and exhaust silencers and Viking safety controls on lubricating oil and cooling water. Once started the Diesel requires little or no attention. In fact, the engineer on watch spends most of his time in the boiler room or outside in the laundry where he is responsible for all machinery maintenance.



The Washington Square Laundry at 429 East 23rd Street, New York City, where a new Chicago Pneumatic Diesel has been installed to relieve overload on steam generating units and reduce electric charges previously paid for purchased power.

There is one other item of auxiliary equipment, and in this case it is of particular importance since the success of the entire installation rests upon its satisfactory operation: namely, Korfund vibration control. It is well known to engineers that 4-cylinder, 4-cycle, internal combustion engines have inherent secondary free forces due to their basic design. It is also recognized that certain subsoil-conditions magnify the natural frequencies of these forces to cause transmission of undesirable vibration. Unfortunately, this proved to be the case after the installation at the Washington Square Laundry was completed, and what threatened to be a rather serious problem arose. Of course, had this situation been known in advance, it would have been relatively simple to place the engine on an isolated concrete base for inertia mass but this could not be considered after installation due to excessive expense and delay. Consultation with Korfund engineers resulted in an effective yet economical solution, which is the first of its kind ever developed for any machinery larger than a single cylinder engine. Its brief description should prove both interesting and instructive for many prospective Diesel users, consulting engineers and engine builders who favor the 4-cylinder unit but have hesitated frequently to install it where foundation conditions are at all doubtful.

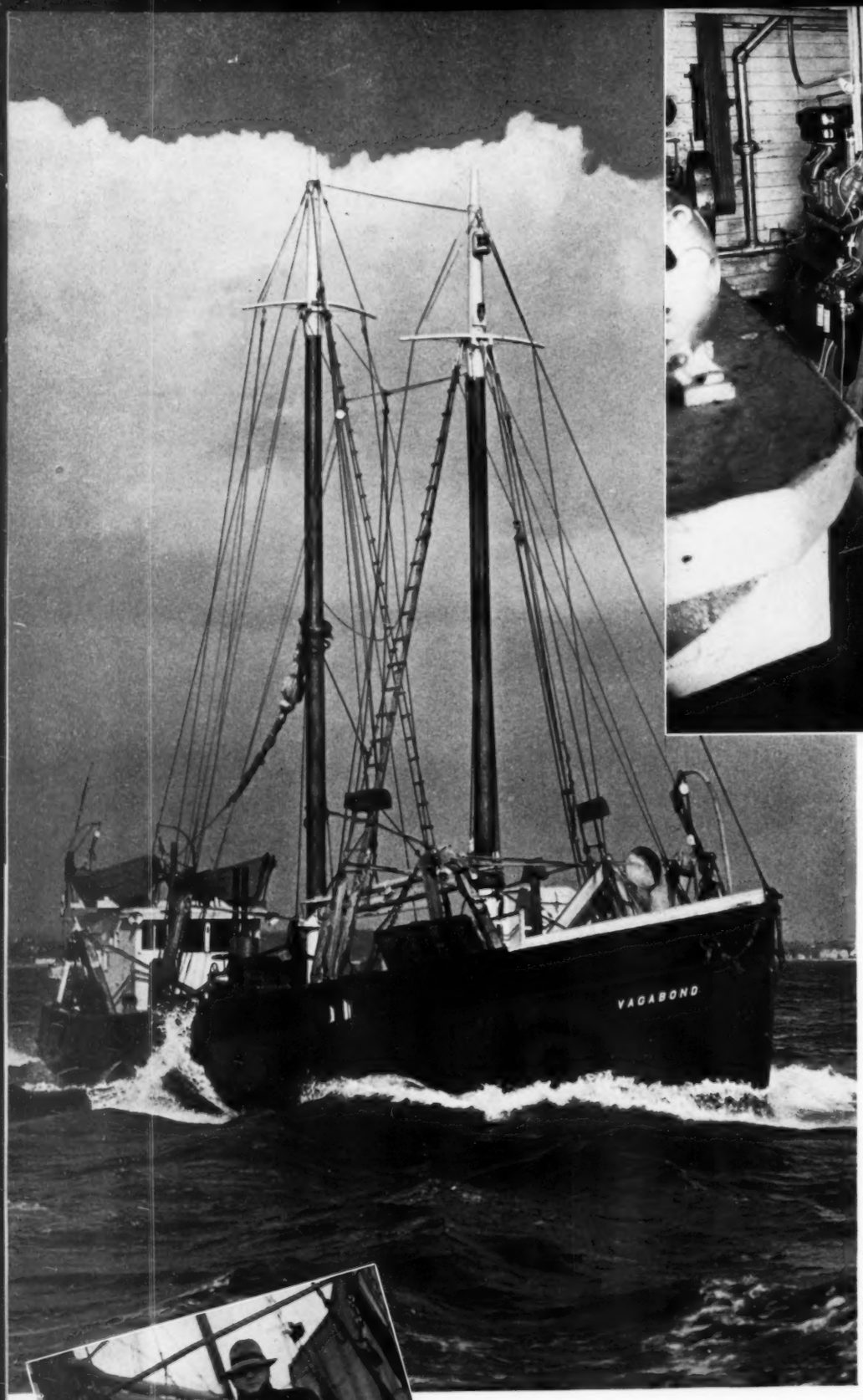
Fortunately, both engine and generator were originally installed on an integral steel subbase. It was quite simple to raise this sufficiently to insert transverse steel channel irons with Kor-

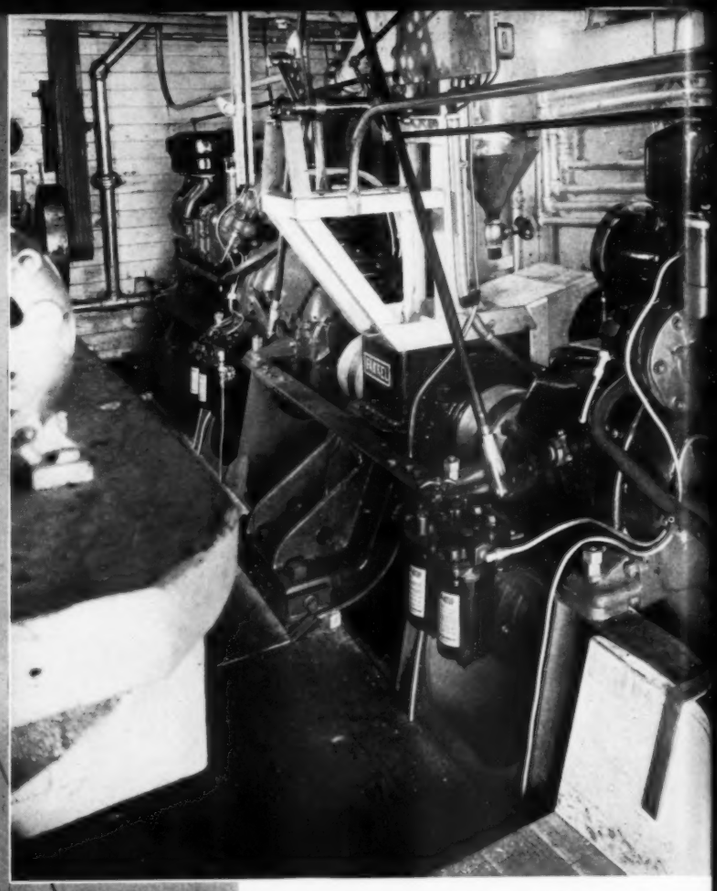


Top—A small corner of the laundry showing some of the motor-driven equipment now operated by Diesel-generated power. Center—The new Chicago Pneumatic Diesel fits conveniently into an unused corner of the engine room. A combination of Korfund Steel Spring Vibro-Isolators and Vibro-Stabilizers provide effective vibration isolation without the stabilizing mass of a concrete block. The Curtis compressor and Levelometer remote reading tank gauge appear in the background. Above—Constant activity on the delivery platform indicates the large volume of business that necessitated a Diesel generating unit for handling peak loads economically.

fund steel spring isolators welded at each end. Thus, the entire assembly was resiliently mounted to eliminate transmission of vibration through the concrete floor. While this would have solved the problem for a 3, 6 or 8-cylinder unit, it still did not control the action of 4-cylinder, secondary free forces, effects of which would then have been accentuated by the resiliency of the spring mountings to cause excessive engine motion even though no vibration could reach the floor or surrounding buildings. This condition was satisfied, however, by adding Korfund Vibro-Stabilizers, which were anchored to the original foundation bolts in the concrete floor and provided the necessary restraint to vertical movement. While the description of such a combination may sound complicated, actually it is not as the engine picture illustrates, and its unqualified success should encourage much wider use of 4-cylinder Diesels by removing economically the previous risk of foundation difficulties.

Chief Andreassen is well satisfied with his new Diesel generator and is now able to strike an economical load balance to meet any power demand without steam plant overload. He reports a saving of about 1,500 gallons of boiler fuel a week in addition to the substantial savings by eliminating purchased power expense. Of particular interest to prospective Diesel users is the fact that no extra personnel was required because of this economical change in power source. Although the engine room attendants were originally hired as steam engineers, they adapted themselves quickly and easily to the new Diesel, which disproves still further the erroneous impression of labor complications.





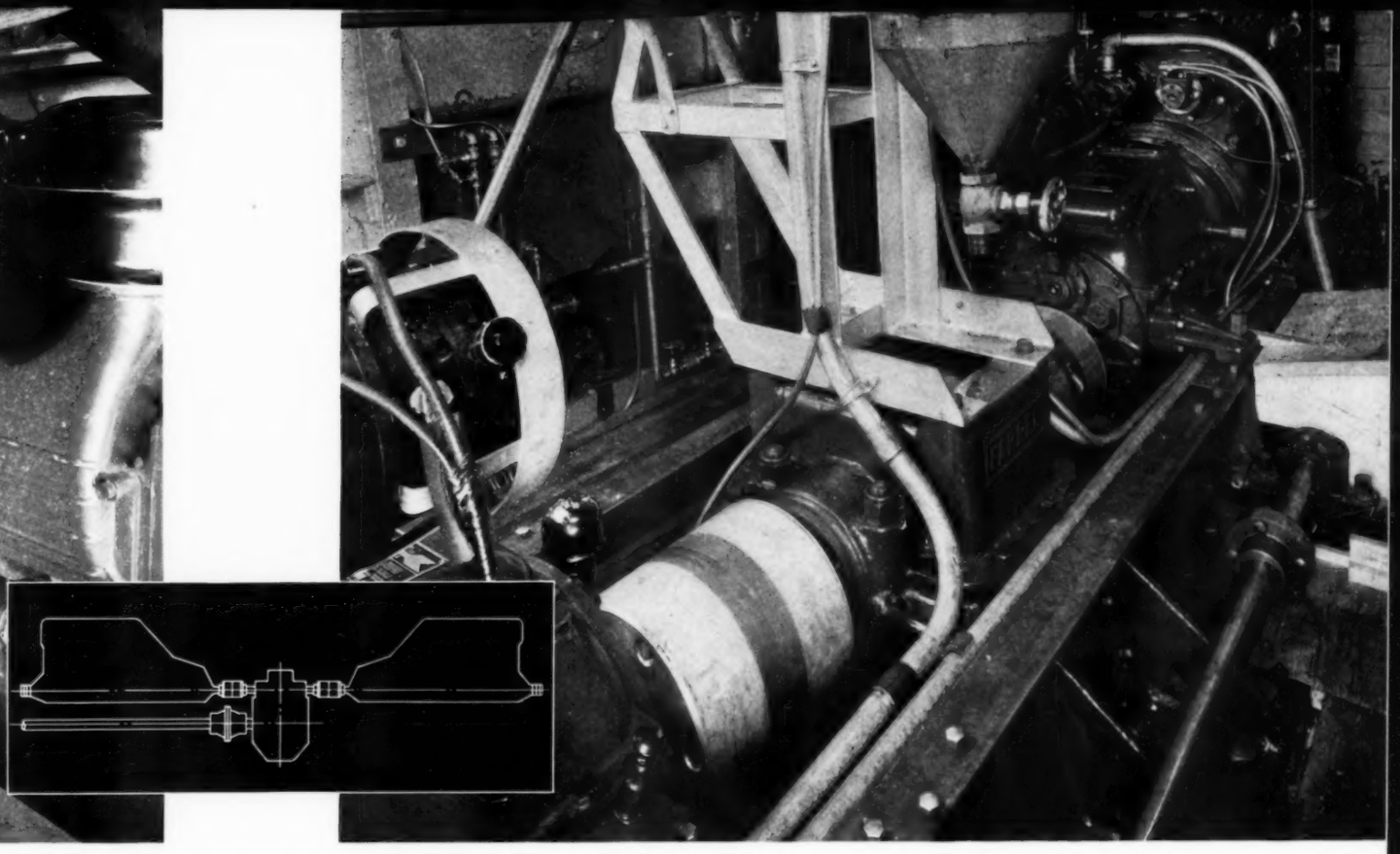
The engine room of the "Vagabond" as it appears after installation of two Gray marine Diesels and the Farrel Reduction Gear Drive. Each engine drives through a Twin Disc clutch and is connected to the pinion of the reduction gear by a Morflex coupling.

The Trawler "Vagabond" during successful sea trials of her new Diesel reduction gear drive.

Captain "Bill" Westerbeke owner of the "Vagabond" is mainly responsible for this unusual departure from previous ideas concerning trawler propulsion.

TRAWLER "VAGABOND" REPOWERED

WATERFRONT observers, at the old whaling port of New Bedford, Massachusetts were treated to something new in fishing boat propulsion recently when Captain Westerbeke's familiar *Vagabond* put out for trials after complete repowering at the Hathaway Machinery Company in Fair Haven. Outwardly there was little visible change in *Vagabond's* appearance and her extra speed may or may not have been noticed from the shore. But news travels fast among seafaring men and there were many who had waited for this first test of the new machinery, so the welcoming committee grew in proportion to their scepticism. This was not, however, the first time that Captain Westerbeke's fishing judment had been questioned to his profit, and he was equally sure this time that he was right.



Schematic diagram showing the tandem arrangement of the engines, Morse flexible couplings and Farrel Reduction Gear connected to the line shaft that was previously used.

This close-up of the reduction gear and flexible couplings shows also the jack shaft which is driving through additional Twin Disc clutches on the "forward" end of each engine. This shaft in turn drives a wash-down pump and air compressor.

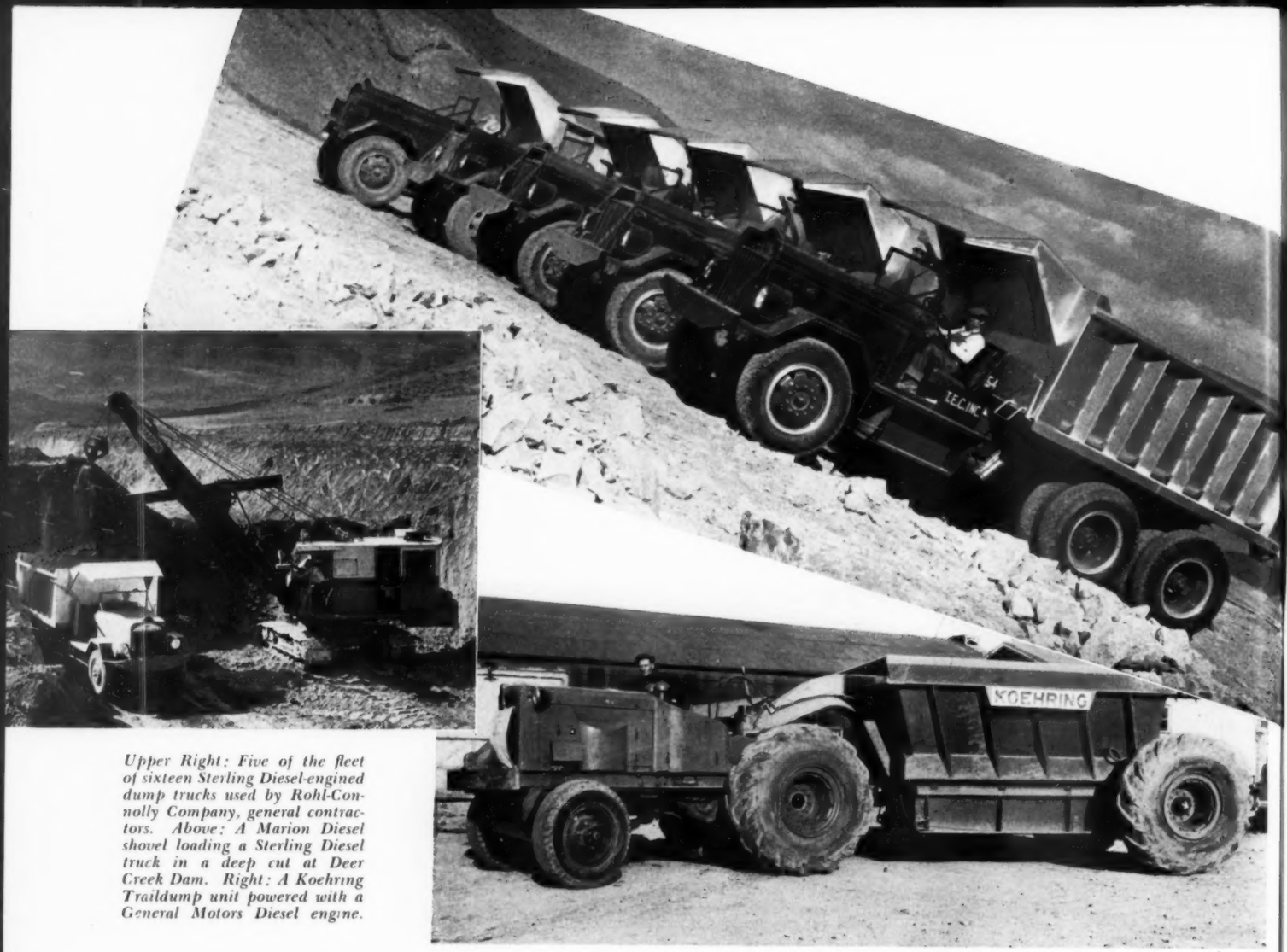
The *Vagabond* is a ship of approximately 70 gross tons with the following principal dimensions: l.o.a. 86.0 ft; beam 19.1 ft; draft 8.6 ft. She carries a normal crew of nine and has a fish capacity of 85,000 pounds.

Years ago, when the *Vagabond* was first built, people doubted the wisdom of so large an investment, for she exceeded the size and power standards then accepted as economically profitable. That theory was exploded, once and for all, when she grossed over a quarter of a million dollars in her first three years of service. It was this same keen appreciation of changing conditions that prompted the Captain's decision to modernize his boat by repowering with other than the conventional slow speed, single engine, direct drive.

As in every other business, there are certain fixed charges that must be met which cannot be controlled. The rising costs of labor, supplies, insurance, maintenance and repairs, in a period of relatively low fish prices, make it increasingly difficult for boat owners to show profits after a year of hard work. The owner of the *Vagabond* was no exception, but he recognized that one factor remained over which he did have full control; namely, engine room economies. Every dollar saved in machinery first cost, operation, maintenance and repairs is extra profit after the fish are sold and all bills paid. Captain Westerbeke did some figuring, asked some questions about certain machinery developments, checked the answers against his knowledge of service conditions, and decided that the *Vagabond* could be made more profitable even though she caught no more fish than before or received no better prices for them. The answer to this paradox was, logically enough, to reduce the cost of fishing. For those without opportunity to inspect the new equipment that accomplishes such economy, a brief description follows:

A Farrel marine reduction gear permits the use of two compact, high speed Diesels on the vessel's single screw, and saves approximately 16,000 pounds of engine room weight. Although power and speed have been increased, fuel consumption has not increased proportionately due to increased efficiency. Engine spares are much cheaper to buy, easier to carry and quicker to install. In fact, all but major repairs can now be made at sea simply by uncoupling one engine from the gear and continuing to fish with the other, which will drive the boat at about three-quarter speed. More time at sea means more fish caught, and reduced maintenance and operating costs mean more profit after they are sold. The reduction of machinery weight also permits better trim at less than full load, which is more often the rule than the exception.

Engines selected to drive the vessel are two Gray marine Diesels, developed and built by General Motors and adapted for marine drive by Gray. Each is rated at 135 hp. at 1,600 rpm. They are placed in tandem with the Farrel gear between, and drive through Twin Disc clutches and Morse flexible couplings. (See diagram). For twin operation both throttles are locked together to synchronize speeds for pilot house control, but can be unlocked instantly for individual operation by the engineer. On what would conventionally be the "forward" ends of each engine, there are power take-offs, also fitted with Twin Disc clutches. These drive a jack shaft connected to a wash-down pump and Curtis compressor. Both engines are fitted with Burgess mufflers. Auxiliary power is furnished by a 7½ hp. Stover, single cylinder Diesel which operates the fish hoist on deck and is also connected to a generator, general service pump and compressor for the air whistle. Willard 32 volt marine batteries are used for engine starting. A Brown pyrometer from the previous installation now records exhaust temperatures for both new 6 cylinder propulsion engines.



Upper Right: Five of the fleet of sixteen Sterling Diesel-engined dump trucks used by Rohl-Connolly Company, general contractors. Above: A Marion Diesel shovel loading a Sterling Diesel truck in a deep cut at Deer Creek Dam. Right: A Koehring Traildump unit powered with a General Motors Diesel engine.

DIESELS BUILD DEER CREEK DAM

ACROSS the trail blazed by Brigham Young and his fearless Mormon pioneers, Diesel-driven machinery is now building a huge dam to harness the Provo River near Salt Lake, Utah. The Provo is the chief tributary whose waters for centuries have helped to fill the Bonneville Basin, the boundaries of which now enclose the large Fertile Valley with its historic sump known as the famed Great Salt Lake and Bonneville Salt Flats.

Deer Creek Dam, located at the junction of Deer Creek and Provo River, will impound 150,000 acre feet of water and form a lake ten miles long. The Rohl Connolly Company of Los Angeles has the general contract. Mr. T. E. Connolly is operating this project with the assistance of O. C. Steves as general superintendent, and Earl Walsh, assistant superintendent. The dam is the earth-filled type with approximately 3,500,000 cu. yds. of selected dirt to be hauled and placed in the dam embankment. The major equipment consists of one Northwest 80D 2½ cu. yd. shovel, powered with a Murphy Diesel engine; one Marion 2½ cu. yd. shovel using a Buda Diesel engine; five Sterling 17 cu. yd. water level dump trucks with Cummins HBD 150 hp. Diesel engines; and two Koehring 8 cu. yd. Traildump units powered with General Motors Diesel engines; six Caterpillar Diesel tractors, and two Caterpillar Diesel engine generator sets furnishing power for utility service.

The principal accessories used on these Diesels are as follows: A battery of Oil Pure refiners is installed on the Diesel engine in the Northwest shovel to remove sludge and carbon deposits from the crankcase, also on the fuel line between the tank and engine as a double check against dirt and water in the fuel, insuring clean injection. A Model E Kohler light plant of 1,500 watt capacity illuminates the bank for night digging.

The Sterling Diesel trucks are equipped with Diesel fuel dehydrators attached to the fuel line between the tank and engine. These devices remove traces of acid and water before the fuel reaches the injection system. A Purolator filter is installed in the fuel line also to remove dirt or solids from fuel. Heil dual telescopic hoists and 17 cu. yd. water level bodies are used on the Sterling trucks.

The completion of this work is expected in 1941, one year ahead of schedule. This Deer Creek Dam will conserve the flow of the Provo River for irrigation in the Salt Lake Valley and provide a large reserve for domestic water supply.

NEW ALLIS-CHALMERS DIESEL CRAWLER TRACTORS

A NEW line of high-speed Diesel crawler tractors – powered by General Motors Diesel engines – has been announced by Allis-Chalmers Manufacturing Company. The first of this new line – the HD 14 – is now available and other models will be released in the near future.

The HD 14 develops 130 horsepower on the belt, 106 horsepower on the drawbar, and weighs 27,000 pounds. The transmission, with six forward speeds and two reverse, provides forward speeds from 1.72 to 7.00 miles per hour and reverse speeds of 2.00 and 3.20 miles per hour.

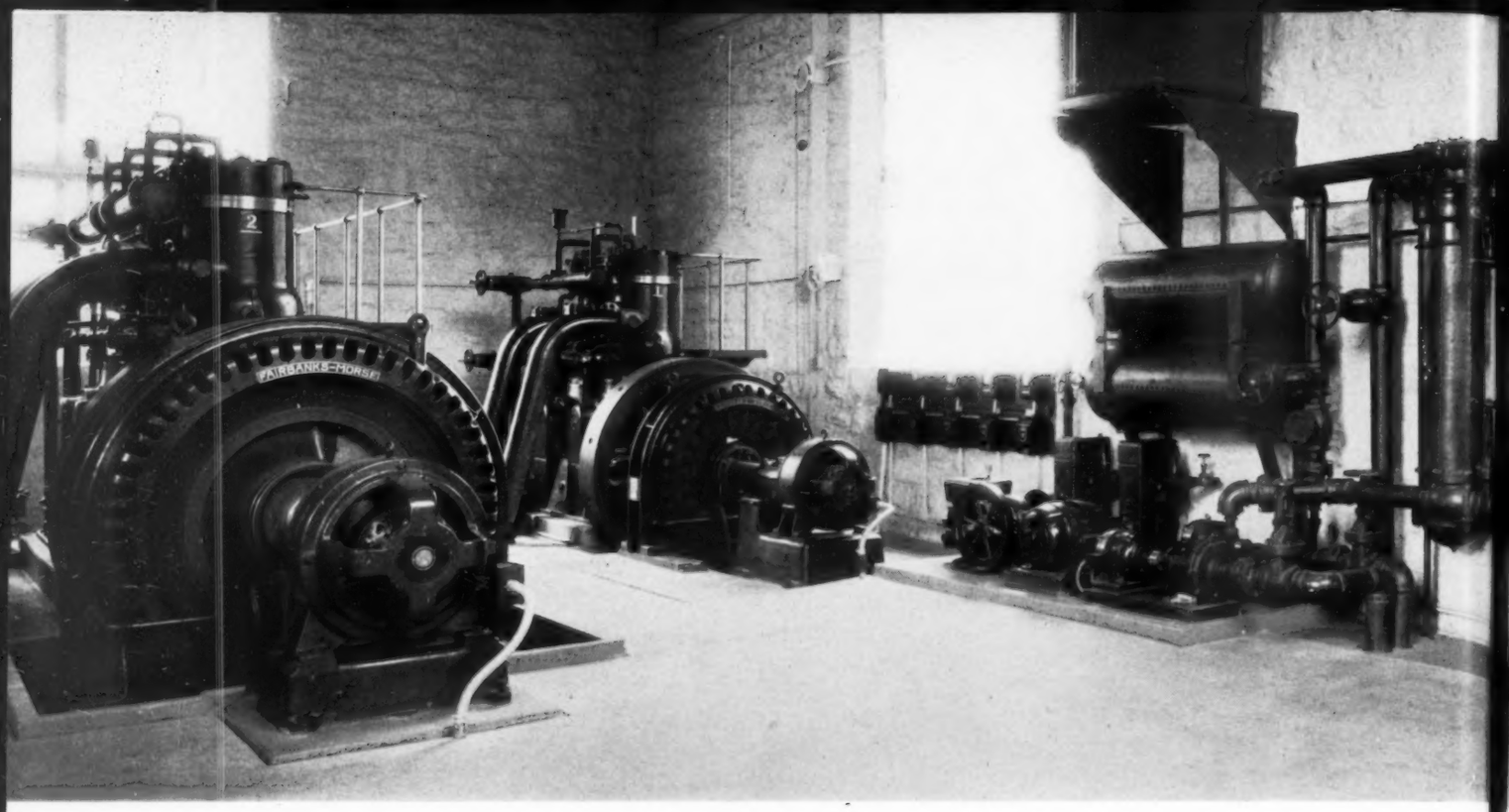
Allis-Chalmers, in testing this General Motors six cylinder, two cycle Diesel engine, has moved over two million cubic yards of earth on two of the toughest construction jobs in the country – the Rio Grande flood control system and the Pennsylvania Turnpike – in addition to extensive tests on logging jobs. This engine also makes possible throttle control of a tractor, giving a range of speeds in any gear down to half rated engine speed, without loss of drawbar pull.

Other features include the use of the new "Positive Seal" truck wheels, recently introduced by Allis-Chalmers, which eliminates the regular ten hour greasing and requires lubrication only once every 200 hours. New and revolutionary steering clutches and brakes of a bi-metallic material are used which are said to make a marked reduction in maintenance expense by increasing the life of these parts many times.

Standard equipment on the HD 14 includes an AC fuel oil filter, Purolater full flow filter, and AC by-pass filter in the lube oil circuit, and two each United intake air filters and precleaners, radiator shutters, and electric starting.

The HD 14 is designed to handle the larger scrapers, 12-14 foot blade graders, bulldozers, trailbuilders, rippers, winches, logging arches, wagons, snow plows, and other auxiliary equipment. A catalog describing this new high speed Diesel tractor may be obtained from the Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

The new Allis-Chalmers HD 14 Crawler type tractor, engined with a General Motors 2 cycle Diesel, is said to give smooth performance unusual in tractors and to be especially sensitive to the throttle.



View showing 300 hp. and 120 hp. Fairbanks-Morse Diesels installed in 1936. Note in the accessory group the Schutte-Koerting jacket water heat exchangers and Crane valves.

CENTRAL NAVAJO AGENCY

By ORVILLE ADAMS

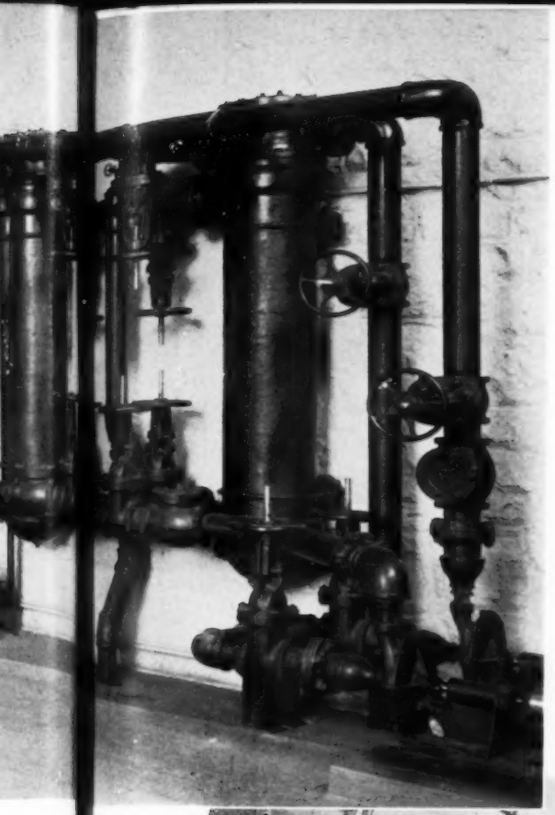
A MODERN Diesel plant at Window Rock, Arizona, the new Navajo Indian Capital, furnishes power and light for the Central Navajo agency. The plant consists of three Fairbanks-Morse Diesel engines totaling 720 hp., and is typical of more than 4,000 hp. of this type of engine installed at various locations on the Indian Reservations by the Bureau of Indian Affairs during the last few years.

Just east of the Grand Canyon and extending through Northeastern Arizona, Southern Utah, Arizona, and New Mexico is the largest Indian reservation in the United States. There are four Indian tribes, of which the Navajo, a pastoral people numbering around 48,000, is the largest tribe. The Navajo tribes are industrious and self-supporting. The government furnishes only educational and medical facilities, available at a number of points where Diesel power plants have been installed to furnish light and power and irrigation facilities. During the last ten years, practically every Indian agency has been completely modernized, new schools, hospitals, refrigeration plants, and the like have been brought up to date.

The compact power plant built of native stone. Also seen in this view are the Marley cooling tower, and Maxim exhaust silencers.

The Window Rock agency is adjacent to the New Mexico state line, where the elevation is 68,000 feet. A short distance north is old Fort Defiance, the first military outpost to be established by the Federal Government in Arizona. Just south of Window Rock is St. Michaels, and hard by is the Franciscan Mission, the earliest mission to be established by the Franciscan Fathers. This interesting region is a short drive from Gallup, New Mexico.

The Window Rock plant, like the others in the Indian service, is equipped with all essential auxiliaries, while, at the same time, the installation is kept as practical and free of complications as possible. The power plant is operated



by the Indians, who have been trained by experts, and the results have been satisfactory.

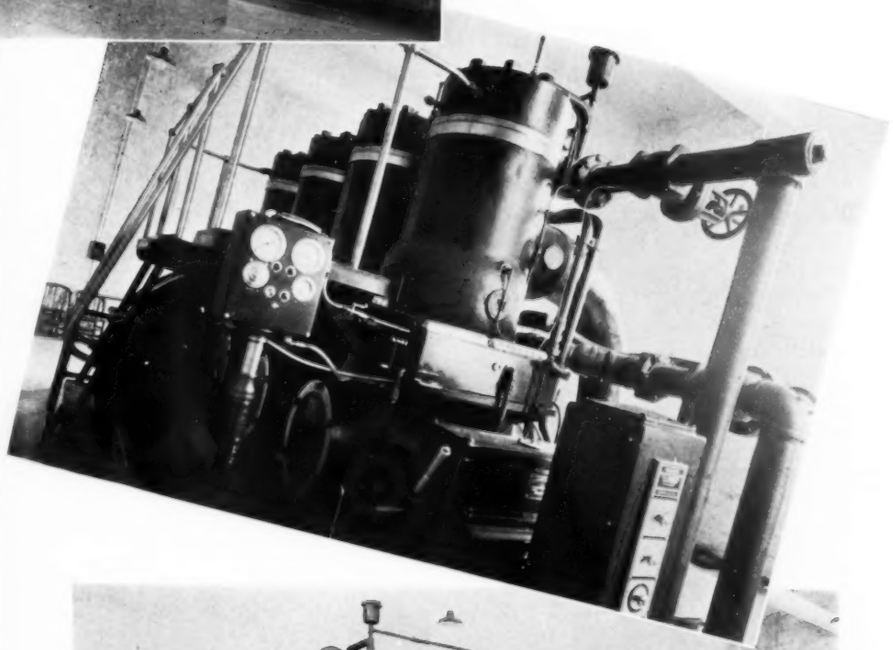
The Diesel engines are direct-connected to Fairbanks-Morse 3 phase, 60 cycle, 2,300 volt alternators with direct-connected exciters, and each engine is equipped with Woodward isochronous governors. In addition to an Alnor pyrometer to indicate exhaust temperature, the plant is equipped with a Garrett Protective control unit, comprising a lube oil pressure alarm control, cooling water temperature alarm and control which can be adjusted to sound a warning at a predetermined period before shutting down the engine automatically. This instrument is a "must" item on all such installations. The fuel oil, stored in tanks, passes through Nugent filters before entering the injection system. All fuel used must conform with Government specifications. A Purolator filter handles the lube oil. The auxiliary group is mounted on the wall in a compact group, and comprises day tanks, air tanks and compressors, a Schutte & Koerting lube oil cooler of the shell and tube type, cooling water circulating pumps and headers and valves, together with transformers and starting boxes.

Originally a steam plant, the present power plant building is rock and adobe construction, a new section having been built to accommodate the last engine installed. Maxim exhaust silencers are mounted outside of the building to which the exhaust stacks are connected in the conventional manner. Air intakes are each fitted with an American Air filter. Since the engines have ample overload capacity, even at the high elevation of this plant, no supercharging was included. A Chisholm-Moore chain hoist and trolley, one for each engine, was installed.

The chemical nature of the water made a closed cooling system desirable and, in this connection, the conventional bank of coils, a Marley cooling tower with necessary pumps, of the centrifugal type made by Fairbanks, Morse & Co., Crane valves, and U.S. Gauges comprise the major items of the cooling equipment.

The switchboard and switchgear, together with the switchboard instruments, were furnished by Westinghouse. The board is simple in design and construction and is of the dead front type. Starters and disconnect switches for all motors were furnished by Square D Company.

In choosing Diesel engines for power plants of the Indian Service, the Bureau of Indian Affairs seeks the most satisfactory layout and simplicity of operation. The various plants so far constructed indicate careful plans and good engineering, with due consideration for the operating conditions and local requirements. Good economy has also been realized, along with success in the efforts of the Agency, to bring light and power as well as the light of learning and civilization to the Navajo. The result is that schools, hospitals, churches, offices for the officials, Indian trading posts, parks, etc., are lighted. Power is available for pumping water used for irrigation in some places. While little or no industrial power has yet been needed, in some locations refrigeration is available.



Above — Operating end of the 300 hp. Fairbanks-Morse Diesel installed in 1938. Note Woodward Isochronous governor in foreground. Left — Exhaust side of the other 300 hp. Fairbanks-Morse Diesel installed in 1936.

PENNSYLVANIA TURNPIKE

An Epic of Diesel Road Machinery

By WILL H. FULLERTON

SECOND only to the Panama Canal in yardage of earth moved, the Pennsylvania Turnpike, a 160-mile super highway extending from Harrisburg to Pittsburgh, is the most stupendous road construction undertaking on this continent. After eleven months of intensive activity, the Pennsylvania Turnpike Commission is feverishly struggling to complete this road within the time limit imposed by the Public Works Administration.

All sorts of Diesel-driven machinery is being pushed to the limit to speed up construction. Over 250 Caterpillar Diesel engines are driving tractors, compressors, shovels and other types of road machinery. Almost every type of earth-moving machinery is employed, giving the contractors a chance to try out every modern method of earth moving. Diesel tractors pull scrapers on cut and fill jobs where ground conditions permit. Bull-dozers, mounted on Diesel tractors, handle short downhill hauls, level fills and help load scrapers. Dozens of Diesel-driven shovels are working in rock cuts and loading into wagons which are hauled by Diesel tractors.

Diesel driven compressors provide air for the hammers used to open up rock cuts for the shovels to work. Diesel tractors pull rippers through shale to enable scrapers to pick up the material and cart it to the fill. Diesel driven elevating graders work on level, ploughable stretches, casting in and loading material into trucks. Diesel motor graders and blade graders, pulled by Caterpillar track-type tractors are doing the cleaning up and final grading work. And so goes the Diesel epic. Probably there has never been such a large selection of modern Diesel driven equipment on any single construction job.

This road has been the dream of engineers for over a century and now in the short span of twenty months of actual construction it is about to become a reality. Without a grade crossing in its entire length, the highway will span valleys on deep fills, hold its easy grades through deep cuts and seven miles of tunnels, and will follow long radius curves.

Before the highway is ready for traffic, 24,000,000 cubic yards of dirt and rock must be excavated, 475,000,000 cubic yards of concrete will be poured into structures and roadways and 45,000,000 pounds of reinforcing steel will have been used. The area of the concrete pavement will be 4,300,000 square yards.

This "First Superhighway of Tomorrow" will be 78 ft. wide, with two 24 ft. roadways, separated by a 10 ft. planted strip in the middle. In tunnels the roadway section reduces to two 11½ ft. traffic lanes. Maximum ascending grades through the entire length of the highway will not exceed 3 per cent. Curves, which average about one to a mile will be limited to about four degrees, with two exceptions at six degrees which will have a radius of 955 ft. permitting maximum sight distance.

There will be no railroad or highway crossing at grade anywhere along the route. At selected points, entrance and exit ramps will be constructed with toll houses located near these points off the highway.

The actual superhighway will start at Middlesex, Pennsylvania, 13 miles west of Harrisburg, the route passing through the southern portion of Pennsylvania piercing the Alleghanies with eight tunnels, by-passing all towns, reaching its western terminus at Irwin, 15 miles east of Pittsburgh. The road is located, where possible, on the southern and western slopes of the mountains, thereby receiving the maximum benefit of sunshine which will facilitate traveling in adverse weather conditions such as snow, ice, rain and fog.

In the event of war, this highway would be a major transportation artery. Men, munitions and other materials of warfare could be moved across the State with the speed and efficiency that are so essential in times of national stress.

There are now 12,260 persons employed on the Turnpike and payrolls to date have mounted to nearly $5,000,000. The economic benefits of this project are being felt far and near through capital investment of foreign contractors who have, for example, home offices and equipment in Ohio, Indiana, Wisconsin and Illinois, and purchase lumber in Oregon and Washington. The total number of contractors, so far, is 55, the number of subcontractors is 36 and they come from 16 states.

The super highway will cost roundly, $61,100,000. This amount is financed on the basis of a P.W.A. grant of $26,100,000 and Turnpike Revenue Bonds of $35,000,000 to be purchased by R.F.C. Through the tolls to be charged the highway will in time pay for itself, and become the property of the State.

The Keystone State is taking the lead in providing the nation with this outstanding highway, which when completed will undoubtedly serve as the key artery of superhighways traversing the entire country. It will represent a major accomplishment in that the Appalachian range extending in a north-easterly direction from northern Georgia to New York will have been conquered by a modern easy grade, divided, express highway. Neither winter storms nor floods will delay the traveler or caravans of trucks for either civilian or military purposes.

Records of speed, efficiency and dependability which Diesel engines are establishing on this road job of the century will prove another boon to the fast-growing Diesel industry.

"Caterpillar" Diesel tractor and Athey side-dump trailer hauling rock from the west portal of the Allegheny tunnel near Bedford, Pa.

Extreme left, "Caterpillar" Diesel tractors with LeTourneau scrapers working 24 hours a day. Average load 9 to 10 yards of rock for a 1,000 ft. haul. Upper left, Diesel shovel handling 215 yards of dirt and rock per hour, 21 hours a day. Below, "Caterpillar" Diesel tractor and LeTourneau scraper working near Houstontown, Pa.

The Motor Sailer "Bunky," top, with her paired Diesel engines shown below. There is a complete engine control from the deck.

The two views above show the trim new Wheeler "Marie V" and her engine compartment with paired Gray Marine Diesels.

"BUNKY," "SWIFT" and "MARIE V"

THE *Bunky* is a motor sailer of unique design built by Huckins Yacht Corporation, of Jacksonville, Florida. She measures 58 feet long, 16 feet beam, and 4 feet 4 inches draft and is equipped with a pair of Gray Marine Diesels models 65 and 66, driving the 26″ x 18″, 3-blade propellers at 1,900 rpm. through 1½:1 reduction gears. Equipped for deep sea fishing, her owner, an Eastern Yachtsman, will use the *Bunky* along the North Atlantic Coast for cruising and sport fishing.

The Topsail Schooner "Swift," a Baltimore Clipper Yacht based on a Brigantine of the same name built in 1778.

Based largely on the brigantine *Swift*, built in 1778 as a privateer, the new *Swift*, completed this year by W. A. Robinson, Inc., of Ipswich, Massachusetts, is a topsail schooner. The *Swift* is 70 feet 5 inches long, 17 feet 11 inches beam, and 9 feet draft, and is fitted with a 4 cylinder 110 hp. Gray Marine Diesel with a 2:1 reduction gear. This power plant turns a 30″ x 20″ 3-blade propeller 840 rpm. for a boat speed of better than 8 knots.

The *Marie V* is a new Wheeler, measuring 46 feet 6 inches long, 12 feet 6 inches beam, and 3 feet 4 inches draft. She is powered with a matched pair of 6 cylinder 165 hp. Gray Marine Diesels on direct drive. Several duplicates of this fast Sport Fisherman are built or building.

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DIESEL ENGINE CENSUS

By A. W. VON STRUVE*

THE total number of Diesel engines produced in the United States during 1939 will be ascertained by the U. S. Bureau of the Census, according to types, horsepower, and value, in the course of taking its twenty-third Census of Manufactures which began January 2, 1940.

The last Manufacturers Census, covering the year 1937, reported that 13,814 Diesel engines of all types were produced. This was more than double the number listed for 1935 and eleven times higher than the 1933 figures.

The 1937 total value of production was $24,000,000 above 1935, when $17,000,000 worth of Diesel engines were turned out.

In the 1937 output totals, 1,625 marine engines were included, 700 of which were for direct connection to propeller shafts, 214 for electric drives and auxiliary use and 711 for connection by reduction gearing. They represented an aggregate value of over $12,000,000, or almost 1/3 of the total amount of all Diesel engines made.

Other major Diesel items were 5,942 stationary engines, worth $17,300,000, and 4,070 aircraft, railway, bus and other motors amounting to $8,041,000. The remainder of the 13,814 included 1,925 hot-spot, hot-bulb and other surface ignition types and 252 injection engines with spark ignitions.

The Bureau has broken down its lower classification which heretofore has stopped at "less than 5 horsepower." The 1940 census will enumerate engines in this category in two groups, those with less than 1 hp., and those of 1 hp. or more but under 5 hp. According to the Census statistical table on horsepower of engines, the bulk of Diesel engines falls in the 50 to 200 hp. class. The table listed 262 stationary engines under that class.

Producers of Diesel engines will be asked to list the total number of engines made, their aggregate horsepower, and their total value and to present these figures under two sub-headings: (1) Compression ignition engines and (2) surface ignition engines. The compression ignition engines will be further sub-divided into three marine engine groups, and stationary and other engines such as aircraft, railway, and tractors. The surface ignition motors will be reported under hot-spot, hot bulb and similar types and injection engines with spark ignition. Questions were included on the schedules after consultations with representative manufacturers including makers of Diesel engines. Only those questions that would throw light on vital manufacturing angles were accepted.

None but Census Bureau employees are permitted to inspect completed reports. The law requiring the taking of periodic censuses of the country's population, resources and business activities includes a proviso prohibiting the Bureau from allowing other governmental agencies or private individuals to examine its confidential files.

The Bureau hopes to have basic information by types of industries available, according to states, by July 1. It will take five months to complete the field work, it is estimated.

*U. S. Department of Commerce, Bureau of Census.

PILOT BOAT *MARYLAND*

(*Continued from page* 43)

emergencies steering can be changed to manual control quickly and simply by locking the hand wheel to its shaft. With the new Diesel a very satisfactory trial speed of 12.5 knots was attained by the *Maryland* at rated engine speed of 300 rpm.

In general appearance and arrangement the *Maryland* differs little from its original trawler design. Crew's quarters are in the typical covered forecastle. Aft of this in the order named are the dining saloon, galley, officers' quarters, engine room and bunk room for pilots, with 16 berths. Although far from a new ship, all quarters are comfortably appointed and modernly equipped with every convenience. It is an ideal sea terminus for pilots waiting for an incoming ship. Absence of noise and vibration insures ample rest and relaxation between assignments.

As is the case with all ship owners the question of operating costs is an important one. It is estimated that the various savings from Diesel operation will total approximately $10,000.00 each year and this means substantial extra profits for all concerned as soon as the new engine has paid for itself. In the meantime the *Maryland* is ready for many more years of dependable service and is standardized with the other ship, which is also Diesel powered, so that the crew can shift from one to the other instead of being idle half of the time. Service operation has more than justified the decision of the Association of Maryland Pilots to convert to Diesel propulsion.

WRITE FOR THIS BOOK

THE October, 1939, issue of "Lubrication," a technical publication devoted to the selection and use of lubricants and published by The Texas Company, contains one of the most interesting articles ever written on lubrication problems created by the modern Diesel. This subject has been covered in complete detail and with a delightful frankness which is seldom encountered in publications of this type.

We heartily recommend to our readers that they write to Mr. F. C. Kerns, The Texas Company, 135 East 42nd Street, New York City, and ask for a copy of the October, 1939, issue of "Lubrication." This book will be gladly sent, so long as the supply lasts, without charge to the readers of DIESEL PROGRESS, but we do ask that your request be written on your business stationery.

NEW CATALOG OF FARREL GEARFLEX COUPLINGS

PLANT executives and engineers interested in the most efficient means of guarding against the effects of misalignment of connected machine shafts will find valuable information in a new illustrated catalog of Farrel Gearflex Couplings just issued by Farrel-Birmingham Company, Inc.

This catalog, No. 443, explains the function of a flexible coupling and describes how Farrel Gearflex Couplings compensate for parallel or angular misalignment or a combination of both, illustrating the details of design and construction with a number of fine halftone plates. It gives the applications, ratings, dimensions and weights of the various types of flexible couplings manufactured by Farrel-Birmingham Company, illustrated with numerous charts and diagrams. Photographs of a number of coupling installations are also contained in this catalog and full information is given on such subjects as service factors and their use in making a selection of a flexible coupling for any particular application, as well as information necessary in ordering, and other data.

Containing 44 pages, handsomely printed in blue and black and with a black and silver embossed cover, Farrel Gearflex Coupling Catalog No. 443 is a reference book of much practical value. Copies may be obtained by addressing Farrel-Birmingham Company, Inc., at 344 Vulcan St., Buffalo, N. Y.

1940 EDITION "YOUR INCOME TAX"

SIMON AND SCHUSTER, New York, has just published J. K. Lasser's new 1940 edition of "Your Income Tax," a 128-page book explaining the important changes in the revenue law made during 1939.

This comprehensive book also explains how to prepare all forms of income tax returns, what form to use in each case, what constitutes permissible deductions; in brief, it covers all phases of income tax problems as applied to both individuals and corporations.

A copy of this book can be had by sending $1 to DIESEL PROGRESS, 2 West 45th St., New York.

MR. W. A. STARCK, formerly engaged as Consulting Engineer of the Patent Works, Milwaukee, and previously Chief Engineer and Factory Manager of the well-known Badger Bumper Company, West Allis, Wisconsin, has become associated in a factory management position with the Young Radiator Company, Racine, Wisconsin, as per announcement made by F. M. Young, President.

Mr. Starck brings to the Company broad experience in engineering, designing matters pertaining to patent development and will give his special attention to manufacturing improvements, efficiency and product improvement.

HERCULES ANNOUNCES DIESEL REPLACEMENT ENGINES FOR 1940 FORD TRUCKS ARE READY

THE complete "Power Package" Diesel replacement engines for the 1940 Ford conventional and Cab-Over-Engine Truck Chassis are in production, it is announced by officials of Hercules Motors Corporation, Canton, Ohio. These new Diesel packaged assemblies, built in accordance with the 1940 specifications, can be as readily installed as in previous models since all required changes have been made—and all necessary fittings are supplied with each unit shipped.

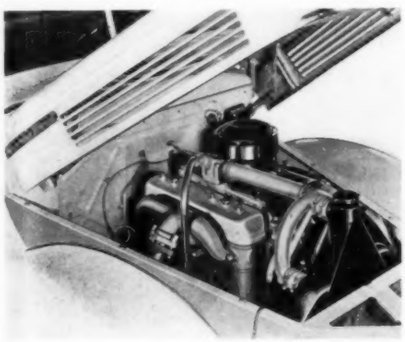
A new installation manual concisely covering the sequence of procedure is also ready, for both the conventional and Cab-Over-Engine

models — and a steady increase in sales is likewise reported.

To market these units a distributor organization has been developed to serve the Ford

dealers and truck operators, these distributors being located at points closely paralleling the location of the Ford Motor Company branches.

Another booklet just issued by Hercules Motors Corporation — and known as "Bulletin



SP-158" — covers the entire line of Hercules Diesels — which line now consists of fifteen models. A comprehensive study, in question and answer form, of Diesel engine design and operation is featured in this new booklet, which is available upon request.

R. LEHR APPOINTED

R. LEHR has recently been appointed sales manager of the Quincy compressor Co., Quincy, Illinois, according to a statement issued by Mac Irwin, president of the company.

Mr. Lehr joined the Quincy Compressor Co. in 1933 and until his recent promotion served as assistant sales manager to J. T. Conder who resigned his post as sales manager, January 1, 1940.

VOLUME FOUR of the DIESEL ENGINE CATALOG is proving to be by far the most popular issue of this useful book we have yet published. First issued in September last, the sale has exceeded all previous totals by nearly thirty per cent. There is so much NEW material in this Volume Four that practically all purchasers of Volume Two and Three have ordered the latest edition. Each volume complements the preceding units, rather than replaces them. You need them all to have the complete picture of this rapidly-growing industry. Many changes have been made in the engines we described last year. Many new engines have come on the market since Volume Three was published. To have a thoroughly comprehensive reference library on ALL American Diesel Engines — you need a copy of Volume Four of the DIESEL ENGINE CATALOG. Refer to page 17 of this issue and use the coupon.

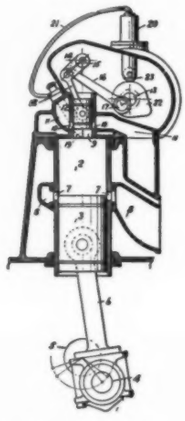
Latest Diesel Patents

A description of the outstanding patented inventions on Diesel and Diesel accessories as they are granted by the United States Patent Office. This information will be found a handy reference for inventors, engineers, designers and production men in establishing the dates of record, as well as describing the important Diesel inventions.

Conducted by C. CALVERT HINES*

2,164,522
INTERNAL COMBUSTION ENGINE

Cecil D. Howard, Swarthmore, Pa., assignor to Sun Shipbuilding & Dry Dock Company, Chester, Pa., a corporation of Pennsylvania.
Application January 22, 1938, Serial No. 186,386
3 Claims. (Cl. 123 – 41)



1. In an internal combustion engine, in combination, a working cylinder, a working piston, a main crank shaft, means operably connecting said piston and main crank shaft, a passage communicating with the interior of the cylinder, a valve adapted for the control of said passage a fuel nozzle let into said cylinder, a second shaft, means affording a driving connection between said main crank shaft and said second shaft, means affording an operating connection between said second shaft and said valve, a fuel pump positioned adjacent said second shaft, means carried by said second shaft for actuating said fuel pump, a conduit affording communication between said fuel pump and said fuel nozzle, means for rotating said second shaft independently of said main crank shaft to simultaneously change the timing of the valve and fuel pump so that the engine will run in reverse direction.

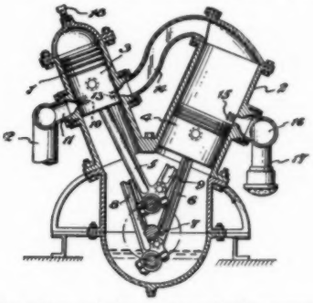
2,167,402
TWO-STROKE ENGINE

Francisco Giró, Buenos Aires, Argentina
Application October 16, 1937, Serial No. 169,485
In Argentina November 23, 1936
1 Claim. (Cl. 123 – 59)

In a two-stroke V-type engine, a pair of closed end motor cylinders, a pair of compressor cylinders arranged at an angle with respect to the motor cylinders, the intermediate portion of said motor cylinders having exhaust and air admission ports arranged in the wall thereof, a piston arranged for reciprocation in each of said cylinders, a conduit extending from the air admission port of each motor cylinder to one of the compressor cylinders to provide open communication with the tops thereof, the exhaust

*Patent Attorney, 811 E Street, N.W., Washington, D.C.

ports of said motor cylinders being arranged nearer the top of each motor cylinder than the admission ports thereof, and the intermediate wall portion of said compressor cylinders having air admission ports and means for moving the piston of each compressor cylinder upwardly



while the piston of the motor cylinder connected to the compressor moves downward whereby the exhaust ports of the motor cylinders are opened before the admission ports thereof so as to prevent back pressure in the conduits and permit the compressed air to thereafter sweep the motor cylinders, and means arranged in the closed ends of the motor cylinders for injecting fuel into each motor cylinder.

2,167,314

MEANS FOR CONVERTING RECIPROCATING INTO ROTARY MOTION

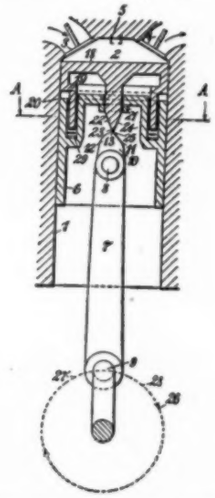
Chandra Sekhar Sarkar, Calcutta, India

Application January 28, 1938, Serial No. 187,541

In Great Britain March 8, 1937

5 Claims. (Cl. 74 — 36)

1. In means for converting reciprocating into rotary motion embodying main and auxiliary reciprocating members constituting a two-part piston or cross-head, of a crank, a connecting rod interposed between the main reciprocating member and said crank and having at least one projecting element rigidly connected thereto, the auxiliary reciprocating member having at least one projecting element rigidly connected thereto, both the main and auxiliary reciprocating members having co-operating surfaces to allow said members to operate as one unit without relative motion between them during compression and expansion strokes except near dead centre, said projecting elements constituting separated extensions of the connecting rod and auxiliary reciprocating member and



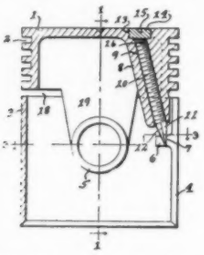
which are brought into operative engagement near the dead centre in a manner to exert more effort to turn the crank over dead centre.

2,168,601

PERMANENT EXPANDER FOR SPLIT-SKIRT PISTONS

Frederick C. Dalton, Portland, Oreg., assignor of one-fourth to W. H. Darby, Salem, Oreg., and one-fourth to E. R. Dalton, Portland, Oreg.

Application March 24, 1938, Serial No. 197,911
10 Claims. (Cl. 309—12)



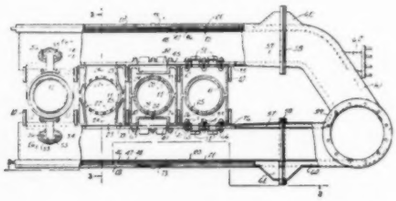
1. In a split-skirt piston having piston pin bearings located within the confines of the skirt, means carried by the head of the piston and engaging the skirt portion of the piston at a place intermediate the top and bottom ends of the skirt for spreading the skirt, said means comprising a boss having a threaded bore extending at a downward and outward inclination to the head and axis of the piston and an adjusting screw accessible through the head of the piston and having a tapered end to project into the split at an acute angle to the piston wall at a point in transverse alignment with the piston pin bearings.

2,167,745

INTERNAL COMBUSTION ENGINE

Hans Davids, Beloit, Wis., assignor to Fairbanks, Morse & Co., Chicago, Ill., a corporation of Illinois

Application March 23, 1938, Serial No. 197,648
123 Claims. (123—195)



1. In combination in an internal combustion engine, an engine frame, a cylinder liner carried by said frame and provided with an exhaust port, an exhaust manifold spaced from said liner, a jacketed member formed as a separate unit, embracing said liner substantially at the zone of said port, said member being provided with a passage arranged to connect said liner port to said manifold, and means for supplying engine cooling fluid to the jacket space of said member.

DIESEL PROGRESS

INDEX OF ADVERTISERS

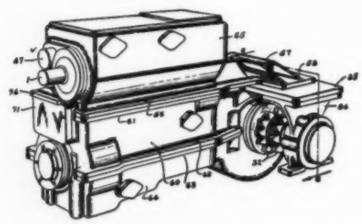
2,167,065

TRANSMISSION CASING FOR INTERNAL COMBMUSTION ENGINE LOCOMOTIVES

William F. Eckert, Ridley Park, Pa.

Original application November 28, 1936, Serial No. 113,126. Divided and this application May 27, 1938, Serial No. 210,439

7 Claims. (Cl. 74 — 606)



1. A gear transmission comprising, in combination, a driving shaft, an intermediate shaft, a third shaft and a transverse bevel gear jackshaft, gearing connecting said shafts for driving the same, and a gear case having lower, intermediate and upper sections separable along planes substantially containing the axes of said intermediate sections having a rearwardly projecting portion which provides a housing for upper section having a rearwardly projecting cover for said bevel gear housing.

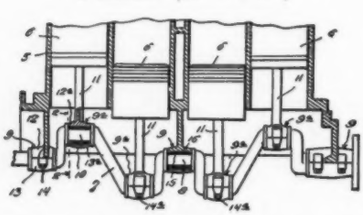
2,167,311

METHOD OF ABRADING CRANKSHAFTS

Frank Postma, Ridgewood, N. J.

Application September 17, 1937, Serial No. 164,390

2 Claims. (Cl. 51 — 278)



1. The method of abrading the main journal of an engine crankshaft without removing the latter from the engine, which consists in substituting in the actual main engine bearing and for the bearing liner sections of said bearing, thin abrading liner sections composed of thin outer shells of soft strong sheet material having abrading material bonded to their inner surfaces and corresponding in form and size to said bearing liner sections, securing said abrading lines sections in the bearing by the means which secures the bearing sections together so that the abrading material thereof contacts the surface of the crankshaft journal, and rotating the crankshaft while in the engine so as to subject its journal to the action of said abrading liner sections.

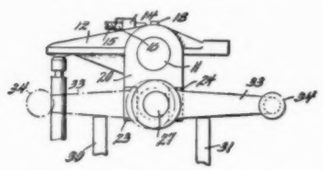
2,167,854

VALVE DEPRESSING MECHANISM

Richard H. Sheppard, Hanover, Pa.

Application August 15, 1938, Serial No. 225,015

6 Claims. (Cl. 123—182)



1. In combination with the exhaust valve of an internal combustion engine, a normally stationary shaft adjacent said valve, a rocker arm mounted to rock freely on said shaft thereby normally to operate said valve, a stop on the shaft and a stop engaging member on the rocker arm, said stop and member being spaced during normal operation of the valve but being positioned for engagement upon rotation of the shaft from its stationary position, means to rotate the shaft through a chosen angle, to cause engagement of the stop and member, and then to move the rocker arm from an inoperative position to open the valve, said means comprising an irreversible mechanism including an eccentric cam and a crank for turning the cam through a predetermined arc necessary to move the rocker arm shaft as recited.

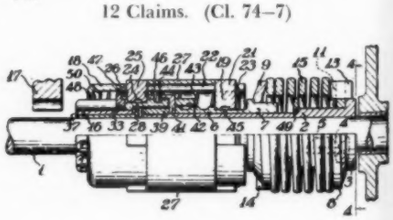
2,167,891

ENGINE STARTER DRIVE

Clinton S. James, Elmira, N. Y., assignor, by mesne assignments, to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

Application November 13, 1936, Serial No. 110,749

12 Claims. (Cl. 74—7)



1. In a starter drive for internal combustion engines, a power shaft, a pinion mounted thereon for movement into and out of engagement with a member of an engine to be started and means responsive to acceleration of the power shaft for moving the pinion into driving engagement with the engine member and thereafter transmitting rotation thereto, said means including means responsive to self-operation of the engine for causing the pinion to overrun the power shaft while remaining in engagement with the engine member, and said first-named means further including means responsive to deceleration of the power shaft for moving the pinion out of engagement with the engine member and returning it to idle position.